The Electrical Industry's Weekly Magazine

June 1, 1959

# Electrical World

Price 50 Cents

A McGraw-Hill Publication

## Underground for Residential:

## Arizona Public Service Chooses Plastic Conduit, 15-Kv Shielded Cable for High-Use Area

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States Seek Clearly Defined A-Plant Regulatory Role... p 40

STEVENS ALICE GS 8
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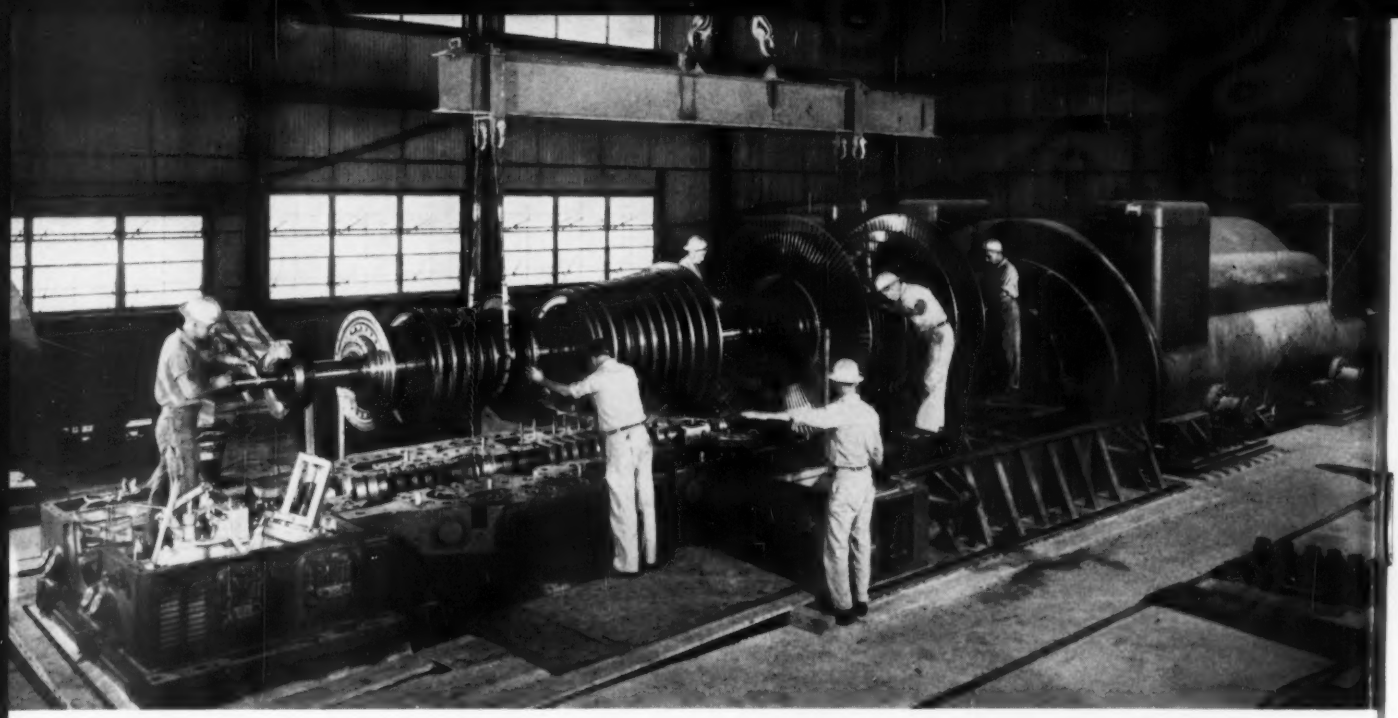

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# Electrical World

Vol. 151, No. 22 JUNE 1, 1959

Published for 85 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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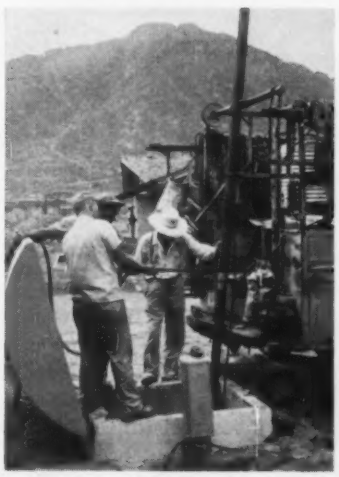

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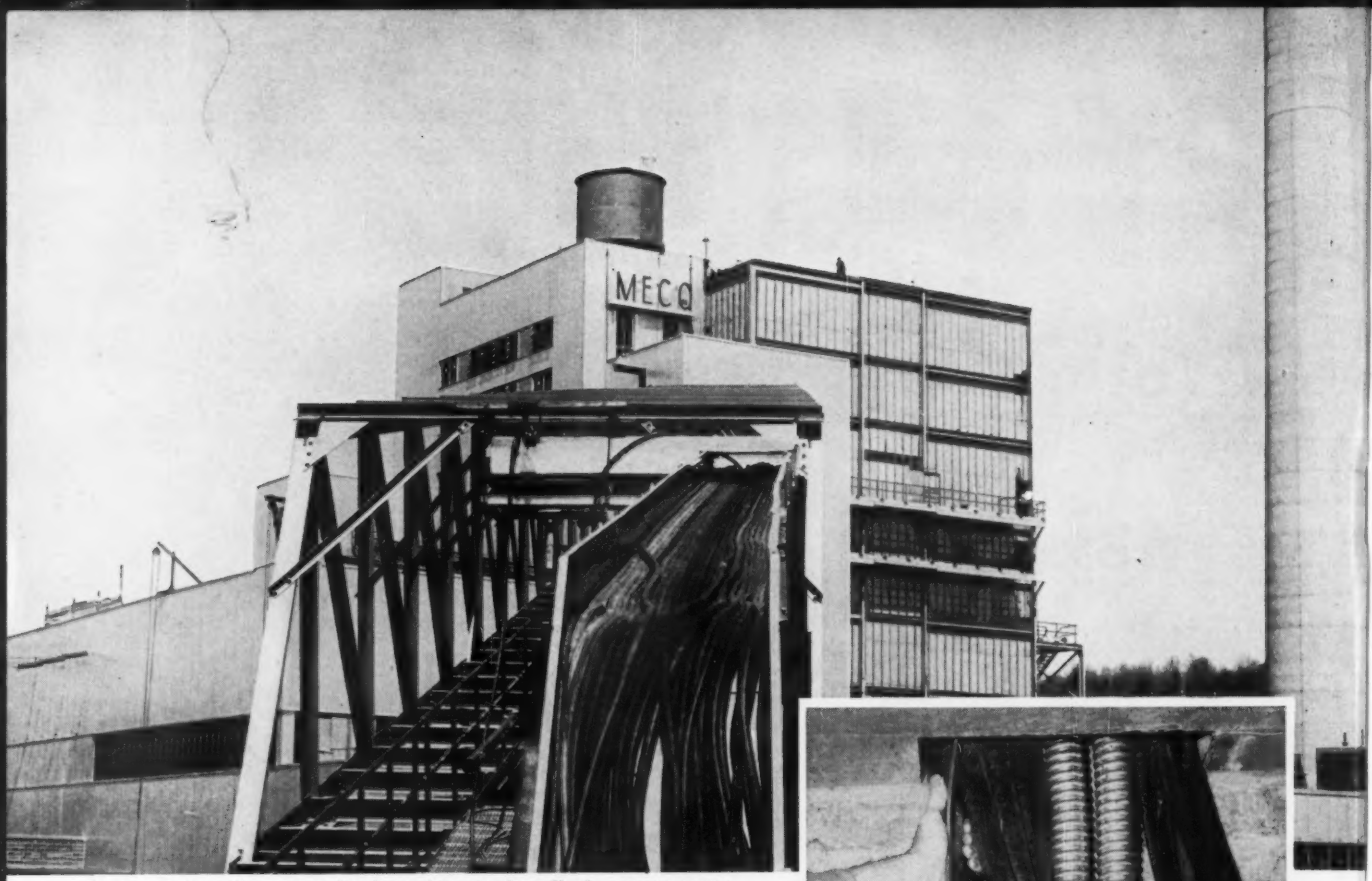


**One construction, one basic cable design finds many uses.** Open coal conveyor structure shown under construction above carries Okolite-Okoprene power and control cables from Metropolitan Edison Company's new Portland Generating Station to coal storage yard. Three types of the same cable meet in the tunnel (right) beneath the switching station: Okolite-Okoprene with CM-OT finish; Okolite-Okoprene with aluminum Loxarmor; Okolite-Okoprene with straight Okoprene sheath.

## Another leading utility picks
# Okolite-Okoprene for maximum margin of safety

Utmost reliability, proved by long-term service records, is the reason why Okolite-Okoprene was selected for the brand new Portland, Pa., Generating Station of the Metropolitan Edison Company—engineered by Gilbert Associates, Inc. Various Okolite-Okoprene cables have been installed for 600-volt power and control service with protective coverings designed for specific installation conditions. For example:

- **To avoid expense of conduit...permit quick addition of new circuits**...Okolite-Okoprene power cable with flexible aluminum Loxarmor, in trays, carries power to motors, pumps, coal conveyors, fans and practically all other operating equipment.

- **For maximum protection against soil corrosion, mechanical damage and insect attack**...Okolite-Okoprene control cable with Type CM-OT (corrugated bronze tape) finish is used for direct burial underground circuits to the switching station in the yard. Finish combines remarkable compressive strength with light weight and easy handling.

- **For great weathering strength and resistance to abrasion**... Okolite-Okoprene control cable with an overall Okoprene sheath is used for most other control circuits within station ...and installed in outdoor trays leading to coal storage yard.

Power stations from coast to coast rely on Okolite-Okoprene for vital power and control circuits—a testimonial to its dependability... its long life and dielectric strength... its resistance to corona cutting, moisture, heat, chemicals and mechanical damage. For further information on this premium quality cable, made by Okonite's exclusive strip-insulating process... and its adaptability to your important circuits, write for Bulletin EW-1085, The Okonite Company, Passaic, New Jersey.

***where there's electrical power... there's* OKONITE CABLE**

6358

# Summer Peaks and the Power Survey

EEI's recently released 25th Semi-Annual Electric Power Survey still presents separate summer and winter tabulations on peak loads, capabilities, and resulting gross margins. However, for the first time, the committee comments, "In reviewing the December peak load data it should be kept in mind that the annual peak loads for some regions occur in summer, . . ."

While this warning is a step in the right direction, it is certainly nowhere near a proper correction of wide-spread impression of margins created by measuring generating reserves at the time of either the winter or the summer peaks.

This same report highlights the need for a more realistic indication of the industry's reserve capability. It shows that summer peaks will continue to catch up with the traditional winter peak so that in 1962 they will be almost identical—but not in the same regions nor on the same utility system.

As we have said before, the only practical way to measure the industry's reserve is to show annual peak capabilities, peak loads, and gross margins. The data is available. We have done it. But it would be more helpful to the industry if the Power Survey Committee would include such a tabulation in its next report.

Fischer Black


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Provides the *widest* variety of voltage combinations.

Since RT&E introduced the industry's first dual voltage transformer three years ago, an increasing number of utilities have joined the pioneer group who first installed these units.

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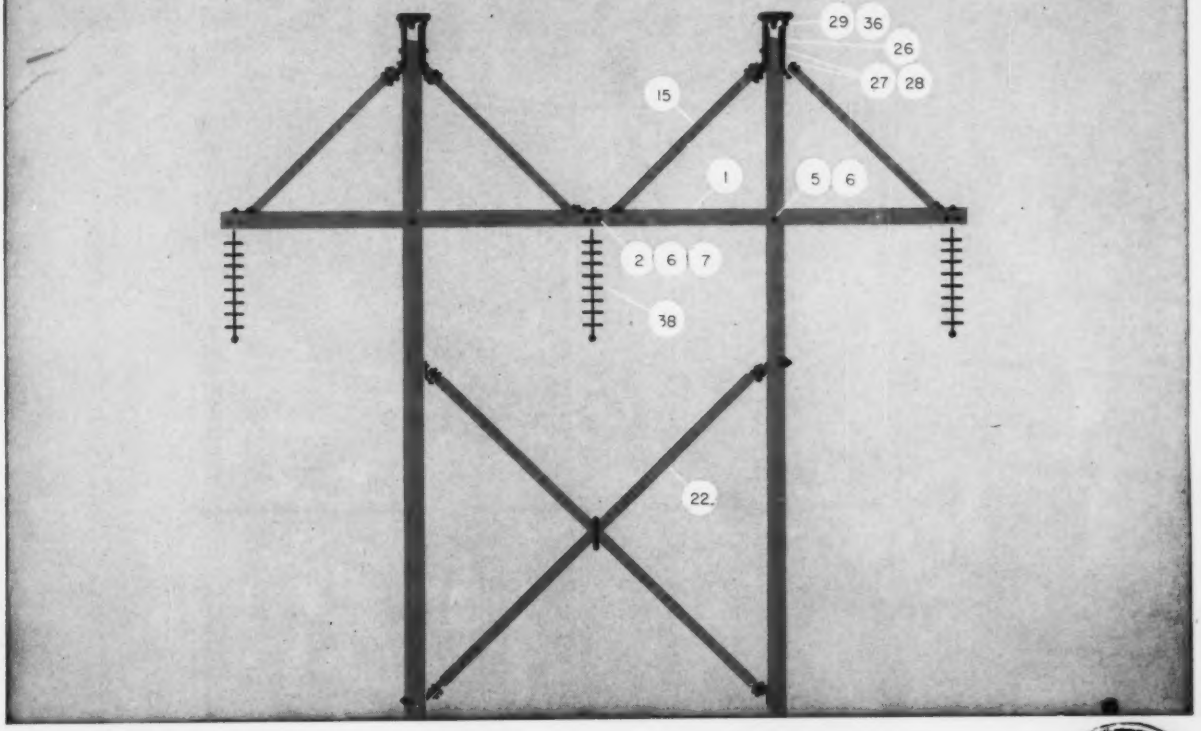
| DRG. REF. # | QUANTITY | DESCRIPTION | DRG. REF. # | QUANTITY | DESCRIPTION |
|---|---|---|---|---|---|
| 792 | 2 | Pole | 15 | 4 | Vee brace 3⅜" x 4⅜" cross section |
| 1 | 2 | Crossarm | 22 | 1 set | Cross brace w/fittings, clamp, ⅞" pole bolts and curved washers |
| 2 | 3 | Steel spacer fitting w/mounting bolts | 26 | 2 | Static wire support |
| 5 | 2 | Stud bolt ⅞" w/washer nuts | 27 | 4 | Machine bolt ¾" |
| 6 | 8 | MF locknut ⅞" | 28 | 4 | MF locknut ¾" |
| 7 | 1 | Bent stud bolt ⅞" x 8" w/2 sq. nuts | 29 | 2 | Clevis |
| | | | 36 | 2 | Suspension clamp for static wire |
| 7 | 2 | Bent bolt ⅞" x 5½" w/sq. nut | 38 | As required | Suspension insulators and fittings |

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POWER TAKE-OFF COMPRESSOR

# 50% SMALLER

**EASY TO OPERATE** The new Worthington rotary power take-off compressor is notable in its starting ease, simple and reliable operation.

# R 30% LESS EXPENSIVE

The facts about Worthington's new rotary power take-off compressor are simply these:

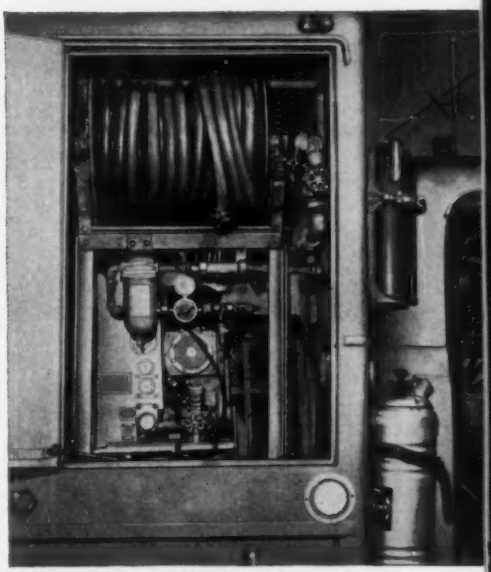
- It is compact . . . takes up 50% less space than conventional self-contained units
- It is 30% less expensive (considering initial investment only)
- It is lightweight . . . 1140 lbs. versus 2400 lbs. for conventional units

Some idea of the compactness of this new rotary power take-off compressor can be gained from a tabulation of its size: only 39″ high, 30″ wide, and 39″ long—*about the size of a desk*. Mounting is simple, too. The two-stage oil-cooled compressor, speed control, engine governor, oil cooler, air receiver, oil separator and oil storage receiver all mount on one common base plate. This compact design permits you to devote more of your truck space for other essential equipment.

The new power take-off unit is easy to operate. Your operator can handle the unit right from the truck cab. Since it's a rotary it will produce more air than reciprocating units because of its infinitely variable capacity control. And it requires less maintenance since there's just one engine to care for.

Why not investigate the new Worthington rotary power take-off compressor for yourself. Many companies that bought one for test have re-ordered. See your nearest Worthington distributor now.

While you're at it, ask him about his complete line of Worthington Blue Brute air tools—each protected by the Guaranteed Availability Plan. (If any of your hand-held Blue Brute tools is in his shop for repair, he will lend you another one free.) Worthington Corporation, Holyoke, Mass. In Canada: Worthington (Canada) Ltd., Brantford, Ontario.



**COMPACT** The new Worthington rotary power take-off compressor requires 50% less space than conventional units. It is only 39″ high, 30″ wide, and 39″ long.

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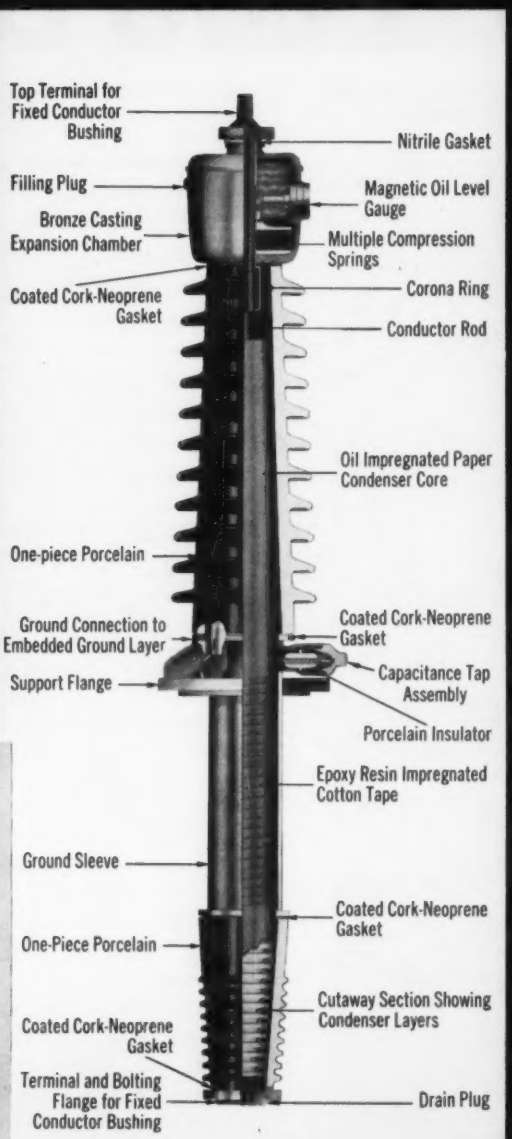
# Why Federal Pacific developed its own superior bushings for oil circuit breakers and transformers

Glen A. Dusch, Marketing Manager—Pacific Switchgear Division, demonstrates the complete line of Federal Pacific bushings: 69 kv, 115 kv, 138 kv, 161 kv, 196/230 kv.




Bushings are the critical point where high voltage lines enter powerful breakers and transformers. Electrical and mechanical performance of available bushings did not measure up to Federal Pacific quality standards. So we undertook the development of our own, meeting new ASA and NEMA standards, superior in performance and more compact than the other designs. It was made possible by Federal Pacific developed electronically controlled equipment that provides a new and more effective wrapping of insulating foil and paper, new impregnation methods, and test devices that permit visual checking of impregnation and gas voids. As a result of this progress Federal Pacific builds a line of high voltage entrance bushings with hard-fact superiority to older, larger designs. Write for Bulletin 4-610, Federal Pacific Electric Company, General Offices: Newark 1, N. J.

FPE **FEDERAL PACIFIC ELECTRIC COMPANY**

The Best in Electrical Distribution and Control Equipment

# The Electrical Week

**FUTURE NEWS ▶** **Look for Florida Power, Gulf Power to file fuel clauses** on the Tampa Electric model soon. Florida PUC feels clause should include generating efficiency, line-loss reductions, as well as raw cost of fuel.

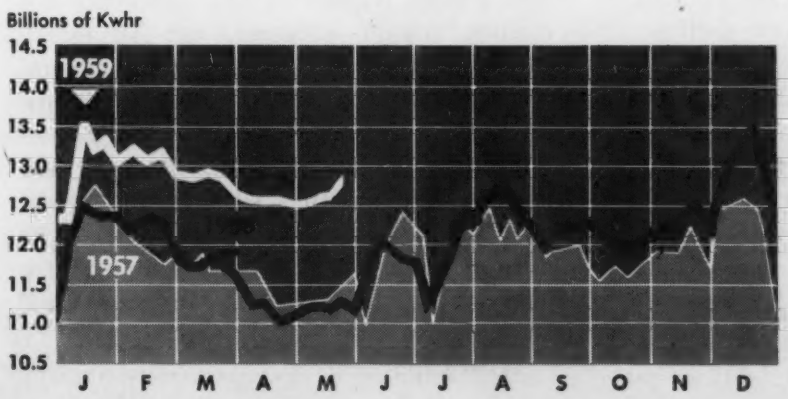
**LATE NEWS ▶** **Rates and Regulation** . . . Consumers Power gets $6,788,485 yearly rate hike; CP requested $15.3 million . . . Indianapolis P&L seeks $19,052 a year rate hike (1.66%) in new contract with City of Indianapolis . . . Arizona Supreme Court affirms decision which says co-ops are public service corporations, and subject to regulation by Arizona Corporation Commission . . . Massachusetts PUC rejects 8% rate hike bid of Northern Berkshire Electric Co.

**Manufacturers News** . . . GE breaks ground for Project EHV, the prototype extra high voltage (460 and 650 kv) line near Pittsfield, Mass . . . Westinghouse buys 11.3 acres and several buildings adjoining its Sunnyvale, Calif., plant for expansion. Westinghouse workers refuse strike authorization at Sharon, Pa., plant.

**At American Public Power Assn meeting . . .** Adm Hyman Rickover says it is "meaningless" to try to predict eventual cost of commercial A-power on the basis of Shippingport experience. However, he says the plant proved a valuable development . . . Interior Under Secy Elmer Bennett claims recreation benefits of future hydro power projects should be emphasized, and that "these values and benefits may exceed the value of power produced."

**Management changes** . . . New Orleans PS elects G. L. Andrus president, succeeding G. S. Dinwiddie who became chairman. Company makes C. L. Nairne exec vp and P. F. Hoots vp . . . W. C. Pierce, E. S. Mortimer are new vps at Eastern Shore PS . . . Jersey Central P&L elects J. E. Logan vp . . . E. A. Yates, Jr., becomes vp at Georgia Power.

## WEEKLY POWER OUTPUT—UP 14.3 % (Week ending May 23), Kwhr 12,931,000,000




Per Cent Change From Previous Year

| | May 9 | May 16 | May 23 |
|---|---|---|---|
| Total U. S. .... | +11.9 | +12.7 | +14.3 |
| New Eng. .... | + 4.6 | + 9.0 | +12.2 |
| Mid. Atlantic .. | + 6.1 | +12.4 | +14.1 |
| Cent. Ind. ..... | +16.3 | +17.6 | +18.7 |
| West Cent. .... | +14.1 | + 8.9 | +11.6 |
| Southeast .... | + 7.9 | + 8.7 | + 8.8 |
| South Cent. .... | +20.5 | +14.1 | +19.6 |
| Rocky Mount.. | +10.0 | + 9.9 | +10.4 |
| Pacific | | | |
| NW ..... | +16.3 | +12.7 | +19.4 |
| SW ..... | +11.7 | +14.0 | +12.1 |

Seasonally Adjusted Index 255.0

Week Ago 254.5 Year Ago 222.4

Source: Edison Electric Institute

# Preview of this Issue

**EVENTS** ▶ **AEC should consult informally with states now on sites,** safety of nuclear reactors, then states could take main jurisdiction after accumulating experience. This is one view voiced at Washington hearings **(p 40)** . . . Legislative effort to change Ohio's "replacement cost new" rate formula has failed **(p 42)** . . . TVA has decided to publicize identical bids received on proposed contracts. Sen Kefauver, meanwhile, says the situation smacks of "administered prices," and calls for an investigation **(p 42).**

**ENGINEERING** ▶ **Arizona Public Service cuts residential underground service costs** with new system which uses plastic conduit, polyethylene primary cables. The idea—to get the cost down to where the average home owner can afford it—has worked well **(p 46)** . . . New analytical and computing tools permit optimum system design and operation. They probe the intricate system relationships and worth of system components under alternative plans for the same reliability, according to GE engineer L. K. Kirchmayer **(p 52)** . . . American Electric Power uses stainless steel paint to protect towers and substations **(p 49).**

**PROCUREMENT & PRODUCTS** ▶ **Looking for ways to pare your materials handling costs?** The chart on **page 60** shows that 46¢ of every stores dollar goes for materials

# Politics and Public Power

### THE CHANGING ATOM PICTURE

Thanks to a combination of economic and political circumstances, the atmosphere in Washington is no longer friendly to the kind of big federal reactor program which came so close to enactment in 1956. And there's no indication the wind will shift anytime soon.

The result is that, for better or worse, the much-discussed acceleration of the civilian reactor program has been put on the shelf.

Many Democrats interpreted the party's sweeping victory in the Congressional elections last November as a mandate from the voters to launch big government spending programs to ease unemployment and to pull the nation out of an economic slump.

When Congress reconvened, Sen Albert Gore (D—Tenn.) reintroduced his proposal for government construction of some $400-million worth of power reactors.

Although the Gore bill was not seriously considered, there was a wide expectation that the Joint Committee on Atomic Energy, which had ordered design studies on three types of nuclear plants in the 200- to 300-Mw range, would now try to legislate federal construction of one or more of these.

And when Chairman John McCone of the Atomic Energy Commission came up with his own budget request of $85-million for the civilian reactor program, top Democrats quickly labeled it as "pitifully inadequate" and promised to authorize additional projects.

Yet, the Fiscal 1960 Authorization Bill which appears ready to win approval by the Democratic-run Congress is a moderate $100-million package which contains little that is offensive to either AEC or investor-owned electric utilities.

What happened?

handling; it is followed by suggestions for getting your 46¢ worth, as well as cutting costs . . . The right decision on what to keep or throw away in your salvage operations spells profits **(p 62).**

**MANUFACTURERS ▶** **A. B. Chance Co unveils its new line of power cutting tools** . . . New GE pole-type distribution transformers carry 20% extra peak load with no sacrifice in life expectancy **(p 63)** . . . Petersen Engineering Co's portable tensioner and powered reel carrier are latest developments in tension-stringing equipment **(p 64).**

**NEW EQUIPMENT ▶** **Interrupter for metal-enclosed switchgear can break 600 amp** without external arcing or smoking . . . Motor controller for squirrel-cage motors are available in two new NEMA classes . . . Pole jack speeds pole pulling and has long-life features **(p 77).**

**MANAGEMENT ▶** **Is normalization a lost cause?** After five years, the question of what utilities should do with liberalized depreciation remains unanswered, but a strong current of feeling emerged from the National Conference of Electric & Gas Utility Accountants that the choice boils down to either accepting a form of "flow-through", or else passing up its benefits altogether **(p 69).**

To find the answer, look at three basic factors:

• The recession has faded, and in Washington the lawmakers feel big spending is no longer good politics.

This has helped the Budget Bureau to stick by its guns in insisting that no more than $100-million be authorized this year for the Civilian Reactor Development Program.

And President Eisenhower, exercising a more vigorous leadership than at any time in his six years in office, has proved by his successful veto of the REA Reorganization Bill that he can make his hold-the-line philosophy prevail.

• Sen Clinton Anderson (D—N. M.), Chairman of the Joint Atomic Energy Committee, has not felt he could afford to become involved in a serious tug-of-war with the present AEC chairman at the same time he is bitterly fighting the confirmation of Admiral Lewis Strauss, the old chairman, to be Secretary of Commerce.

Also, due to sincere efforts on the part of both men, they have developed a friendly relationship which encourages compromise.

• With power reactor development programs being soft-pedaled and delayed all over the world, it becomes increasingly hard to justify acceleration of the U. S. effort for the sake of preserving "world leadership."

In addition, the pending legislation includes two projects for rural coops and municipally-owned power companies. Thus, the public power bloc can't say it's being left out of the program.

So much for 1959. It could be that spending in 1960, an election year, will again be popular. But one factor working against the advocates of a big federal plan then will be that fully three commercial atomic plants in 100-to 200-Mw range will begin operation.

# Executive Reader

**Automatic data logging in steam stations** shows an installed cost of about $0.50 per kw for two 200-Mw units. Conservatively, this application could save at least $52,000 annually in cost of labor and fuel. Numerous indirect benefits include a smaller control room, greater efficiency and accuracy in paperwork handling, and greater plant reliability. **F. A. Ritchings, Ebasco Services Inc, E&O Section, SEE Belleair, Fla., April, 1959.**

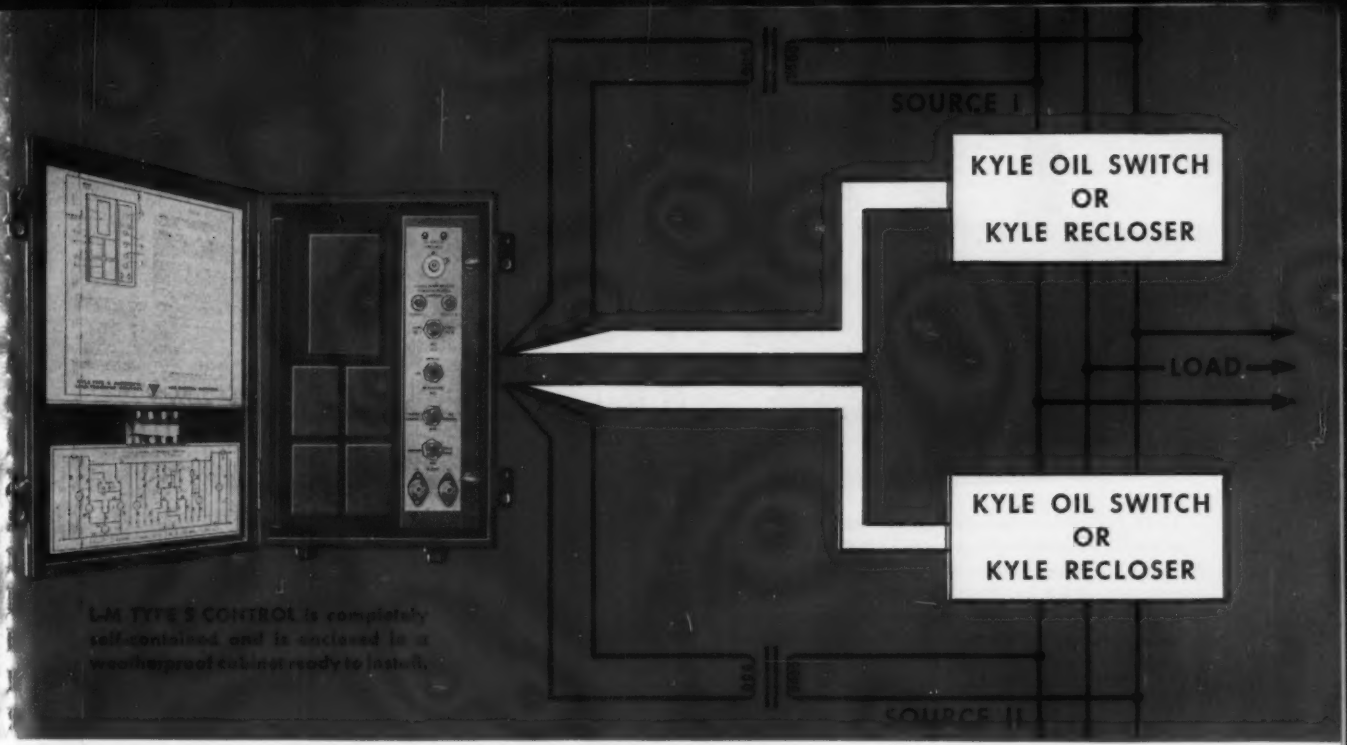
**Higher and higher voltage is the trend today** in transmission lines. Looking ahead to the time when these higher voltages will be reality, system planners must include this eventuality in their long-range planning. Associated problems will not be unlike those which have confronted the utility industry for many years but their solutions may be harder to determine. **Public Utilities Fortnightly, May 7, 1959.**

## NUCLEAR NOTES

**New Production Reactor** (NPR) using a graphite moderator and intended for the production of plutonium but incorporating features that will permit addition of electric power generating equipment, if desired, is to be constructed at Hanford, Wash., under AEC contract by Kaiser Engineers. Design and engineering is being performed by GE, the prime operating contractor at Hanford. **Atomic Energy Commission.**

**An atomic-powered electric and heating plant** that can be knocked down for air transport is being designed and built by the Martin Co under a cost plus fixed fee contract, jointly financed by the Air Force and AEC, estimated to run $5,387,450. The plant will be installed at Sundance, Wyo., AFB. **Atomic Energy Commission.**

**Organic liquids as reactor coolants** have been attracting growing interest. They cost 40¢ a pound compared with $28 for heavy water. Such coolants could prove economically attractive in small and medium size nuclear power plants. They have a high boiling point permitting a low-pressure system in the reactor. They are less corrosive than water at higher temperatures permitting use of more normal structural materials. But they are affected by radiation and require replacement. To further evaluate their use, Atomic Energy of Canada, Ltd, announced a $600,000 contract for design study of a reactor called OCDRE; Organic Cooled, Deuterium-moderated Reactor Experiment. **Canadian Weekly Bulletin, Dept of External Affairs, Ottawa.**




L-M TYPE S CONTROL is completely self-contained and is enclosed in a weatherproof cabinet ready to install.

# Kyle Type S Load Transfer Controls Give Economical Service Continuity

## L-M new Type S control provides automatic load transfer for installation where a continuous power supply is a must.

The new Kyle Type S Automatic Load Transfer Control is a self-contained system, working with oil switches or reclosers to provide maximum service continuity with a minimum of investment. It provides a primary radial system with reliability approaching that of a network system at only a fraction of the cost. It is most economical compared to any other load transfer system.

The Type S is a preassembled, prewired packaged control, in a weatherproof cabinet. It is suitable for installation at hospitals, shopping centers, industrial plants—wherever continuity is important.

Designed for use with Kyle Type NR and VR oil switches or Type R and W reclosers, it provides a wide degree of variation in the selection of the power feeder. Since the control and the switches or reclosers are separate from each other, power can be supplied to the load by operating either switch or recloser manually, while the system is being installed or maintained—no need for service interruption. Switches and reclosers have self-contained operating mechanisms.

This control, by sensing the voltage on one phase of each source, actuates the motors or solenoid operators of the oil switches or reclosers, and connects the distribution feeder to the desired source.

Time-delay relays are adjustable through a wide range to insure coordination with backup protective devices and to prevent oil switches from opening when a fault occurs.

Contact your L-M Field Engineer or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

**Choice of Operating Sequences Illustrating the Versatility of Type S Control**

1. Transfer to the alternate source, after a time delay, when the preferred source is de-energized and voltage is present on the alternate source.
2. Transfer back to the preferred source automatically, after a time delay, when normal voltage is restored to the preferred source.
3. Elimination of the second outage by paralleling sources when returning the load to the preferred source.
4. Holding load on the alternate source after normal transfer from the preferred source. (Manual operation is required to transfer load back to the preferred source.)
5. Manual transfer.
6. No-preference operation for use when either source is considered desirable for continuous load supply.

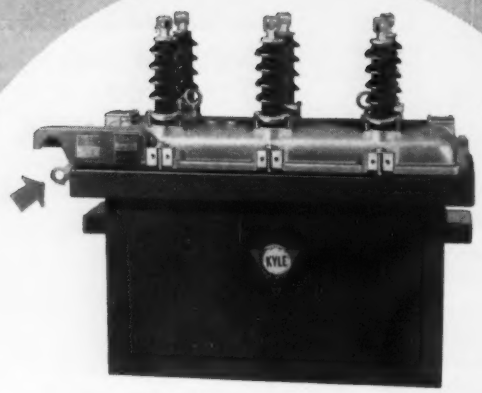
**NEW L-M TYPE S CONTROL.**
**Automatic load transfer switch provides continuity of service . . . with minimum of dollar investment.**

**LINE MATERIAL® Industries**
McGRAW-EDISON COMPANY
Kyle® Switchgear

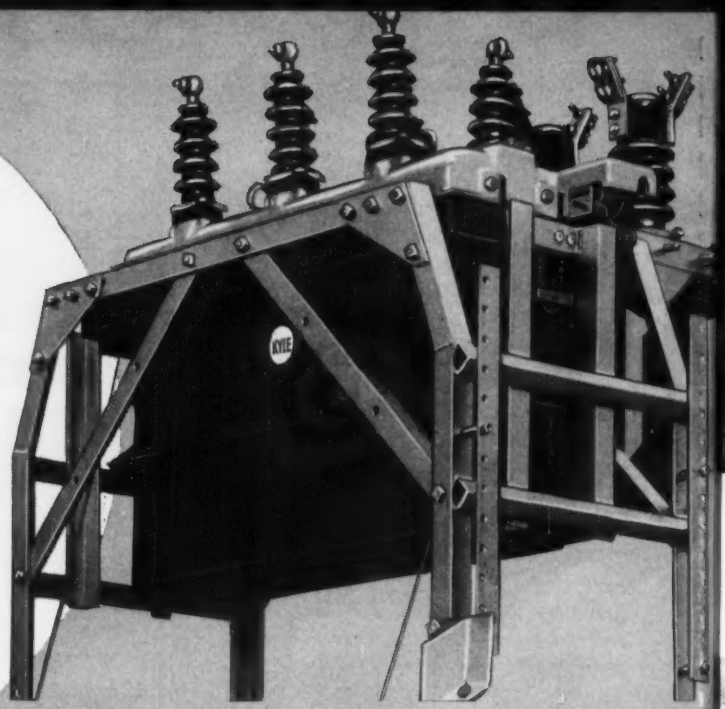
McGRAW EDISON

398

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT



KYLE TYPE R heavy-duty 3-phase recloser. Available in 12 current ratings from 25 to 400 amperes, 2.4 to 14.4 kv. Interrupting ratings up to 6,000 amperes at 4.8 kv. Note that the trip-free operating lever functions both for manual opening and manual closing. Further, this lever is a lockout position indicator when in the down position.



KYLE TYPE W heavy-duty 3-phase recloser is rated from 100 to 560 amperes, 2.4 to 14.4 kv; interrupts up to 12,000 amperes at 4.8 kv, 8,000 at 14.4. Can be unbolted from mounting frame easily with common wrenches; no wrench extensions or unusual tools required.

# Kyle Types R and W Heavy-Duty Reclosers Offer Unmatched Features and Operation

## Dial your operating sequence! Finger-tip, positive, pretested indexed positions for: (1) timing; (2) operating sequence; (3) number of operations to lockout.

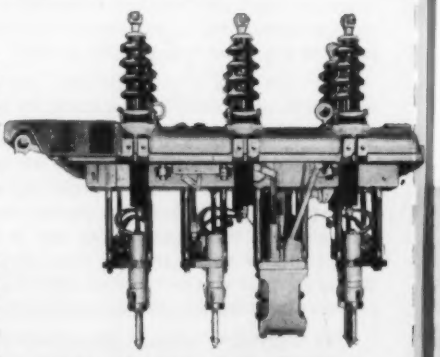
With more extensive recloser engineering and field experience than any other manufacturer, Kyle has produced in the heavy-duty Types R and W reclosers, apparatus that is completely unmatched by any similar products now available.

Kyle reclosers offer many advantages in operation that make coordination easier and more exact; reduce burndowns; and thus improve service continuity.

The Kyle operating mechanism is readily accessible. Contacts are visible and may be inspected when open. Coils may be changed in the field. The number of fast curves may be selected and changed simply by turning a dial. Two retarded curves are precalibrated at the factory, so no "cut and try" adjustments involving expensive testing time are needed if the user desires to change from one retarded curve to the other. Every Kyle Type R and W is completely and accurately factory precalibrated on all of its time-current characteristics, not just the single characteristic specified on the order. Actually, every R and W has over a hundred factory timing-test operations.

### Let Us Supply Bulletins

These are some of the many superior design and operating features that make the Kyle Types R and W the best reclosers on the market. Ask the L-M Field Engineer for complete information. A large library of literature is available—on application, operation, and maintenance. He will be glad to supply whatever you can use. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.



MECHANISM WITH TANK LOWERED. With the Kyle unit, the recloser frame can raise or lower the entire recloser, or lower the tank only, for inspection or maintenance. Kyle reclosers are completely self-contained; no additional external power source is required to operate them.

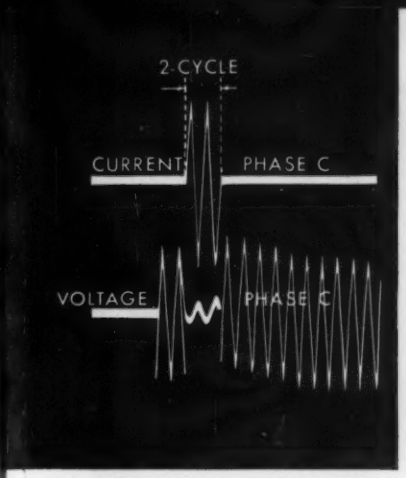
**LINE MATERIAL® Industries**

McGRAW-EDISON COMPANY

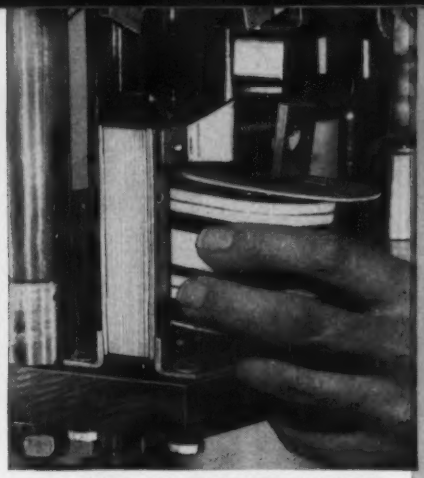
**Kyle® Switchgear**

McGRAW EDISON

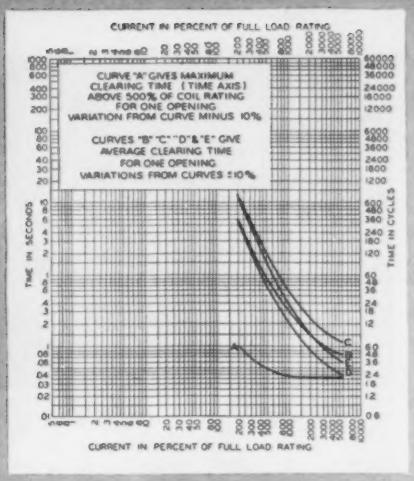
DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT



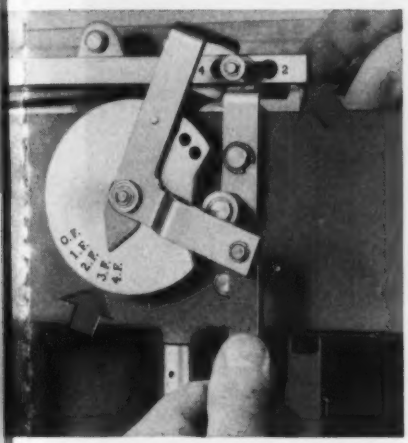

**OSCILLOGRAM** shows typical example of current interruption. *Maximum* clearing time over most of fault current range for the Type R is 2 cycles; 2½ cycles for the W. This is total, starting at the instant the fault occurs, and includes sensing, operation, and final arc quenching.



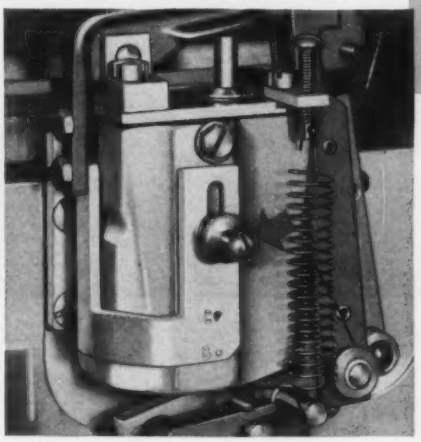
**CHANGING THE SERIES TRIP SOLENOID,** which determines the tripping current, is easily done in the field. Both reclosers are available in a wide range of tripping currents, affording a wide degree of application and permitting proper feeder protection as the load changes.


CURRENT IN PERCENT OF FULL LOAD RATING
CURVE "A" GIVES MAXIMUM CLEARING TIME (TIME AXIS) ABOVE 500% OF COIL RATING FOR ONE OPENING VARIATION FROM CURVE MINUS 10%
CURVES "B" "C" "D" & "E" GIVE AVERAGE CLEARING TIME FOR ONE OPENING VARIATIONS FROM CURVES ±10%
TIME IN SECONDS
TIME IN CYCLES
CURRENT IN PERCENT OF FULL LOAD RATING

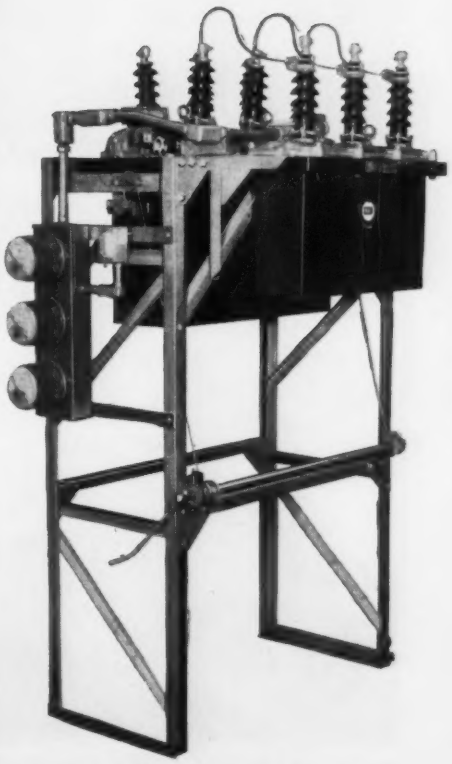
**CHOICE OF FIVE CURVES**—one fast (instantaneous) and four time-delay curves—is available on phase tripping. Delay curves B and C are obtained with one piston assembly, by simple change shown above. Or, with modification of the piston assembly (not a field operation), the reclosers are available with choice of D or E curves. No "cut and try" adjustment in the field.



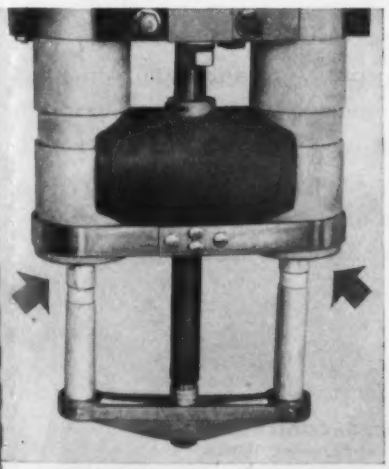
**THESE RECLOSERS** may be set for 2, 3, or 4 operations to lockout by simply re-indexing the lockout bar. Changing the easily accessible dial permits selection of 0, 1, 2, 3, or 4 fast operations. Any remaining operations to lockout will then be the delayed operations on the B or C curve, whichever is selected.



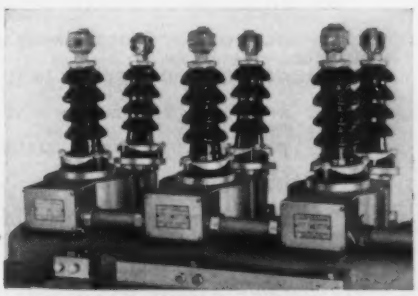
**FOR CHOICE OF** time-delay curves it is only necessary to loosen this thumb-screw and index the adjustment bracket to the curve desired. Both retarded curves have been test-board-calibrated, and no "cut and try" adjustment is necessary in changing to the other curve.



**RIGID SUBSTATION MOUNTING FRAME.** Windlass hoists recloser to any desired height without additional equipment. Since entire mechanism is suspended from the head, the recloser frame can raise or lower entire recloser, or lower the tank only, for easy inspection or maintenance.



**DOUBLE-BREAK CONTACTS** with oil cross-blast arc extinction. In the open position the contact tips are accessible for visual inspection—no disassembling necessary. Contacts cannot fall *closed*.

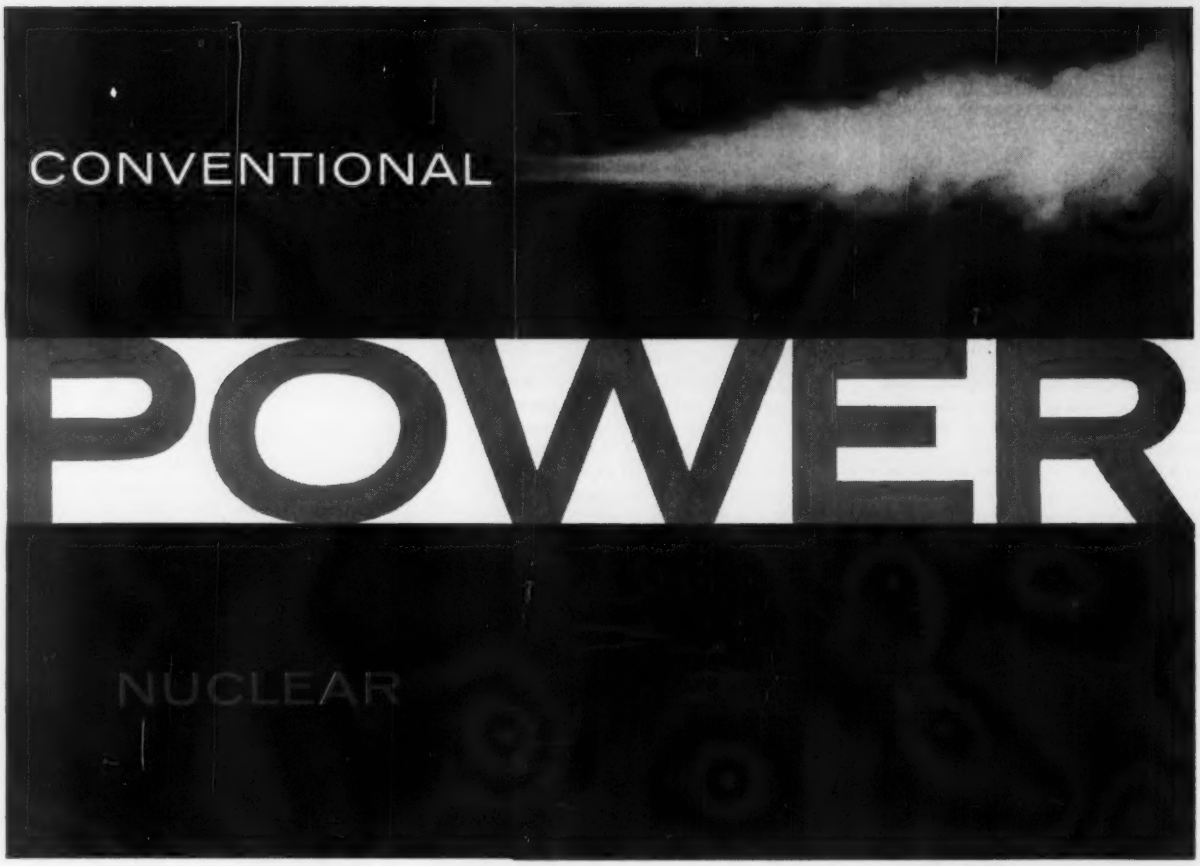


**BUSHING CURRENT TRANSFORMERS** are available as an accessory. These are mounted on the *outside* of the tank, where terminals are accessible by means of a screw plate. No untanking necessary.

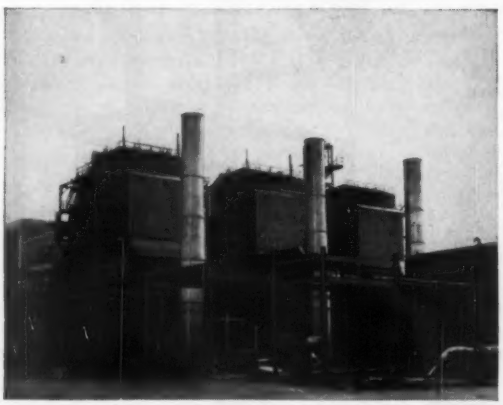
**LINE MATERIAL® Industries**

McGRAW-EDISON COMPANY

Kyle® Switchgear




## Kaiser Engineers can design and build your power plant quickly, economically.



960,000 pounds/hour steam generator plant producing process steam, compressed air and 31,250 KW of electricity for alumina plant. Designed and built by KE.

A 475,000 KW power plant in Louisiana. America's Engineering Test Reactor in Idaho. A 100,000 KW industrial steam power plant in Pennsylvania. The engineering study for the AEC's Gas Cooled Graphite Moderated Power Reactor. A $10,000,000 dual-purpose process steam and power plant. New nuclear development projects in Europe, Asia and Latin America. This is Experience—electric power from both nuclear and fossil fuels. To which Kaiser Engineers couples Ingenuity to pioneer, to develop new methods, to achieve efficient plants quickly, at low cost. For experience, ingenuity, and a cost conscious approach, call or write KE. Today.

KAISER ENGINEERS

**KAISER ENGINEERS** engineers-contractors
Contracting since 1914

Division of Henry J. Kaiser Company • Oakland 12, California • New York, Pittsburgh, Washington, D.C., Buenos Aires, Calcutta, Montreal, Rio de Janeiro, Sydney, Tokyo

ALLIS-CHALMERS modern line for '59

Exclusive electrical and manual stored-energy closing mechanism.

**Convenience** — control devices located on breaker front—safely available even with door closed.



**Safety**—*(a)* interlock prevents movement of closed breaker; *(b)* latch prevents rocking past disconnect position.



**Flexibility**—each stage of auxiliary switch assembly is individually adjustable without disassembly.



**Accuracy** — direct acting series-trip device is set easily, using calibration scale and adjusting knob.

## Plus value in every detail

## Allis-Chalmers all-new 600-volt metal-enclosed switchgear for 75,000-ampere interrupting service

Just a few of the operating . . . safety . . . and application features of A-C's new design are shown. There are many other features that will interest you, such as unitized construction, the use of polyester glass insulation, and spring-held dust seals.

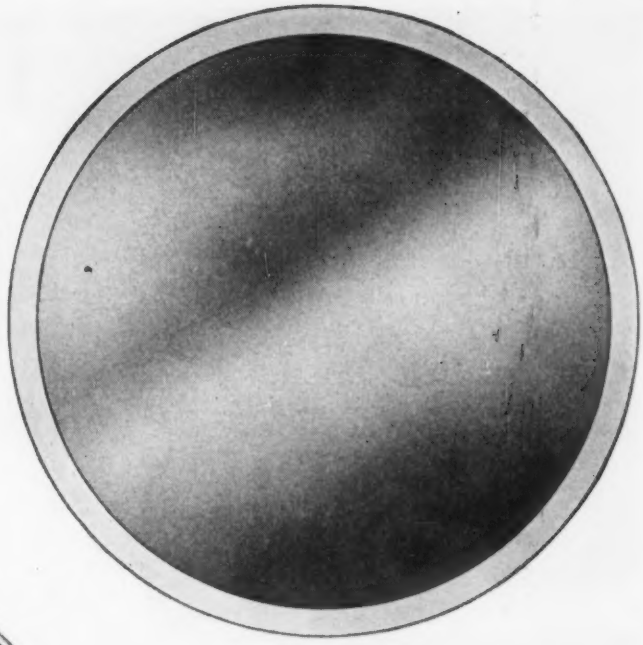
*Get the details! Contact your nearby A-C office or Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.*

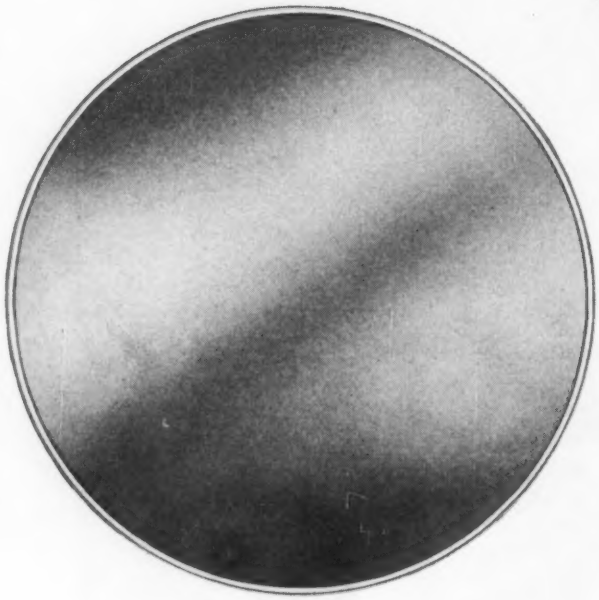
Plan to stay ahead... MODERNIZE!

A-1038-E

**ALLIS-CHALMERS**

# New "D" coating for Bethlehem Strand...





## ... outlasts "A" coating 4 to 1

You can count on Bethlehem's new "D" bethanized coating for long service even in highly corrosive atmospheres because it is four times the weight of the old reliable "A" bethanized coating. The "D" coating, applied to the wires of Bethlehem strand by a special electrolytic process, is not only a heavyweight; it's also uniform in thickness.

With the addition of the ductile, 99.9 pct pure zinc "D" coating, Bethlehem now offers four weights of bethanized coating. The "A" coating, although the lightest, is adequate for most applications where atmospheric conditions are good; the "B" coating is twice as heavy; the "C" coating is three times as heavy.

Perhaps you'd like to know more about Bethlehem strand. Or you might like to know which coating weight will give you best results. If so, please feel free to get in touch with our nearest sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

**BETHLEHEM STEEL**

BETHLEHEM STEEL

ALLIS-CHALMERS modern line for '59

## Caliband Control

**Adds accuracy • Cuts human error • Saves time**

For the first time you can adjust or test voltage level without changing customer voltage or interrupting regulating service. In addition, human error is eliminated because compensator elements need not be set to zero before testing voltage level. *Caliband* control does it automatically. All of this saves time.

***Caliband*** unit makes Allis-Chalmers regulator controls simpler to set and more accurate.

***Caliband*** control is standard on all Allis-Chalmers regulators. It may be purchased separately, however, for use in adjusting or testing voltage level on earlier model Allis-Chalmers regulators on your system.

**See it in action!** *Caliband* control can be demonstrated on your desk with an actual unit. Contact your nearby A-C office or Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

*Caliband* is an Allis-Chalmers trademark.

*Originators of 5/8% step regulators*

**ALLIS-CHALMERS**

A-1040-E

## Citric Acid -- Dowell's New Service for Cleaning Stainless Steel Process Equipment

Now, for the first time, plant operators can be sure of a new degree of safety in the cleaning of their pressure units containing austenitic stainless steel—for example, heat exchangers, stainless-clad pressure vessels, atomic reactors, and supercritical-pressure steam generators. Citric Acid service by Dowell provides a new, effective method for these special chemical cleaning situations.

The Citric Acid used in Dowell chemical cleaning is inhibited with an *exclusive chloride-free* inhibitor. Cleaning with this new field-proven solution assures a chloride-free solvent system, and thus helps prevent chloride stress-corrosion cracking.

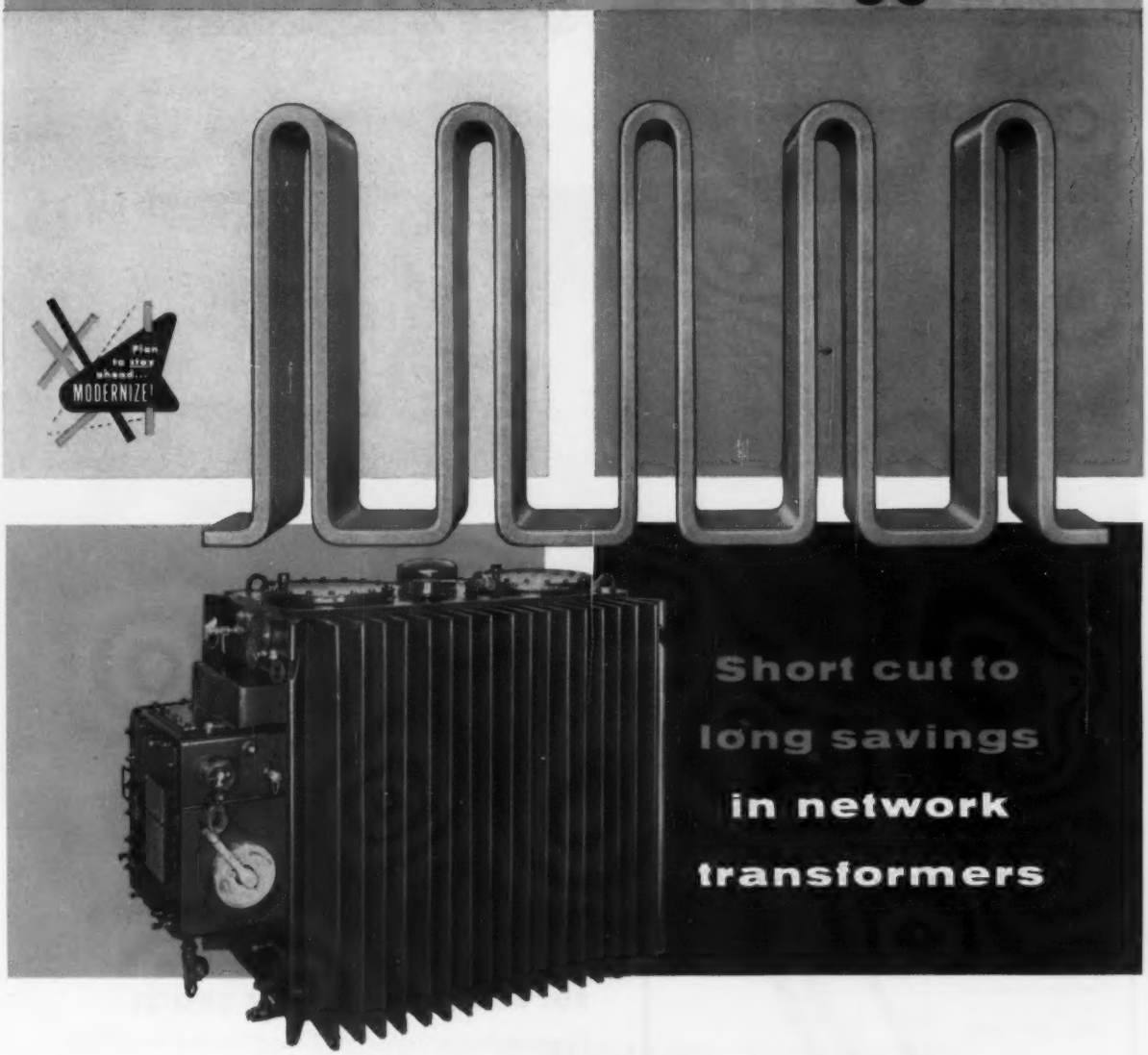
Dowell Citric Acid also provides other significant advantages: Citric Acid stabilizes dissolved iron and helps prevent precipitation of insoluble iron compounds when neutralizing chemicals are used. Flushing of the unit is not as difficult when Citric Acid is used. Citric Acid is especially suitable where stainless steel and other metals are used together in construction of the unit.

Citric Acid cleaning with a chloride-free inhibitor is just one of the new ideas from Dowell research. Other recent contributions include the new "white glove" standards of cleanness, copper removal agents and the new jetting device for cleaning heat exchanger tube bundles.

Ask your Dowell representative about Citric Acid service and Dowell chemical cleaning programs for your plant equipment. Dowell, the leader in chemical cleaning service and research, operates in every major industrial area through 165 offices and stations. Dowell, Tulsa 1, Oklahoma.

*Chemical cleaning service for all industry* DOWELL
DIVISION OF THE DOW CHEMICAL COMPANY

ALLIS-CHALMERS modern line for '59




**Reduced Size and Weight Cut Installation Costs**

*Smaller vault requirements* per kva is another economy advantage of this redesigned unit. With more compact units to handle, work crew efficiency is increased. And, of course, increased kva may be installed in existing vaults.

## Corrugated tank surface simplifies cleaning and painting

Fluted tank design with its flowing surface continuity adds years of serviceability because: (1) Sharp corners and crevices are eliminated. (2) Easy visual inspection facilitates checking surface condition. (3) When required, reconditioning is simplified.

The proved maintenance economy of corrugated cooling surfaces is just one of the many more-for-your-money features of the new Allis-Chalmers network transformer.

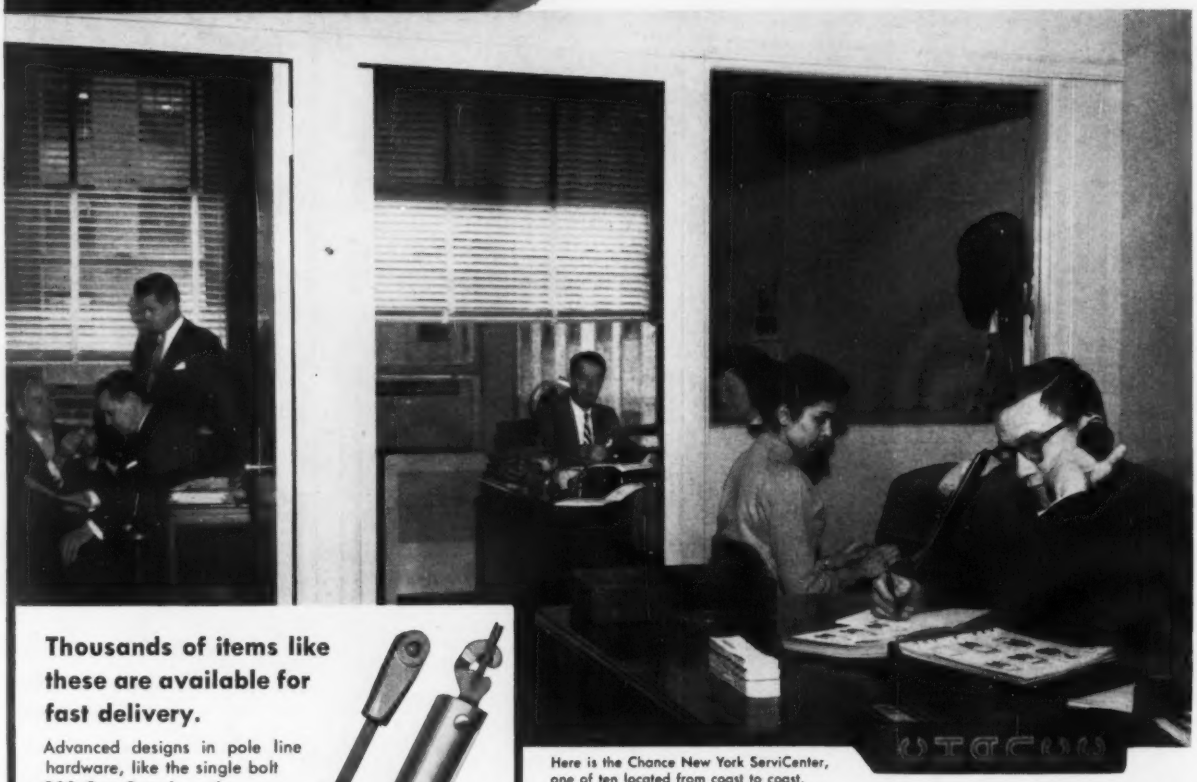
*For complete information, call your local Allis-Chalmers representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.*

A-C ALLIS-CHALMERS

A-1017-E

FOR
# LOCALIZED SERVICE
ON POLE LINE HARDWARE

SPECIFY **CHANCE**



Here is the Chance New York ServiCenter, one of ten located from coast to coast.

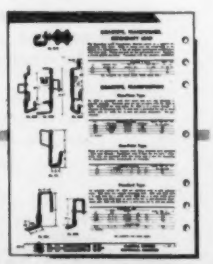
**Thousands of items like these are available for fast delivery.**

Advanced designs in pole line hardware, like the single bolt 808 Guy Guard . . . the new mechanically-wedged fiberglass strain insulator . . . and brand new ideas in brackets and wireholders, as well as standard pole line hardware, are carried in Chance ServiCenter stocks.

## Strategically located Chance *ServiCenters* put stocks and service within easy reach

From anchor to pole top—Chance makes everything you need in guying materials and pole line hardware. Now, ten new ServiCenters put these Chance products within one-day shipping distance of the great majority of Chance customers and distributors. Contact the Chance ServiCenter in your area for prompt quotations, product information, technical assistance and fast delivery.

**The easy way to find pole line hardware information in a hurry . . . Check your Chance "dictionary style" Catalog Pages.**



INDUSTRIES

# A. B. CHANCE COMPANY

CENTRALIA, MISSOURI

A. B. Chance Co. of Canada, Ltd., Toronto

CP59-9

ALLIS-CHALMERS modern line for '59

600-VOLT
Thru-Type
CURRENT
TRANSFORMER

## Easy to install...
## even easier to maintain

**Install in minutes** — Thru-type design eliminates bolted primary connections. Mount it in any position. No hangers or enclosing boxes are required. Large oval window holds two 750 MCM insulated cables.

**No maintenance needed** — Molded of epoxy-resin, this transformer never needs painting. It has excellent dielectric properties and can withstand wide temperature variations and severe mechanical shocks.

*Get the complete story from your A-C man or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.*

Plan to stay ahead... MODERNIZE!

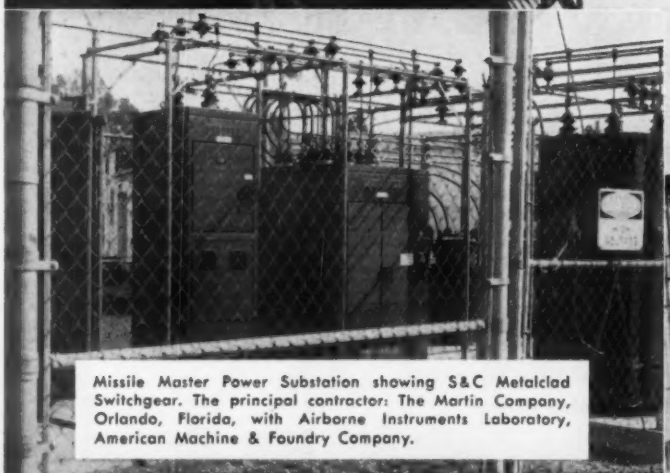
A-C ALLIS-CHALMERS

A-5945-E

*For the U.S. Army Missile Master—*

# Where Reliability is a Command:—

## S&C Metalclad Switchgear is used on the primary power supply



Missile Master Power Substation showing S&C Metalclad Switchgear. The principal contractor: The Martin Company, Orlando, Florida, with Airborne Instruments Laboratory, American Machine & Foundry Company.

At Fort George G. Meade, Maryland, this vital electronic installation collects information on the location of aircraft, presents this information on displays for decision, and then distributes selected data to NIKE missile batteries in a large defense area. The high-voltage power supply for the radar and electronic devices uses S&C Metalclad Switchgear for primary protection and switching.

Specified as part of this ultra-reliable nerve center of the Nation's defense are S&C Metalclad Switchgear units, using Power Fuses and Load Interrupters. See inset, left.

Such installations will be used in many areas throughout the United States, where NIKE installations protect population and industrial centers.

For further information about S&C Metalclad Switchgear, write to S&C Electric Company, 4421 Ravenswood, Chicago 40, Ill.

*Specialists in High-Voltage Circuit Interruption for Utilities Since 1910*

S&C

**METALCLAD SWITCHGEAR**

ALLIS-CHALMERS modern line for '59

# Today's biggest condenser

## 200,000-square-foot condenser now in operation at Fisk Station of Commonwealth Edison

Some man-sized problems were presented by this unit... not the least of which were shipping and erection. Special Allis-Chalmers well-center cars permitted shipment of the entire shell in only four sections. Special alignment techniques developed by A-C cut installation time.

Today it serves a 327-mw Allis-Chalmers steam turbine generator. Note the compact, space saving rectangular shape pioneered by Allis-Chalmers and made practical by the A-C guided-flow condenser design.

For help on your condenser problems, large or small, contact your nearby A-C office or Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

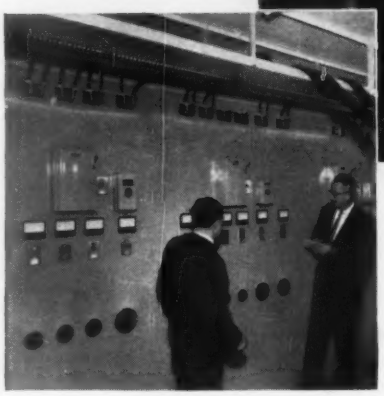
A-1046-E

**ALLIS-CHALMERS**

# Blackburn's

# New Testing Facilities

## give accurate test data for utilities, precise evaluation of design ideas

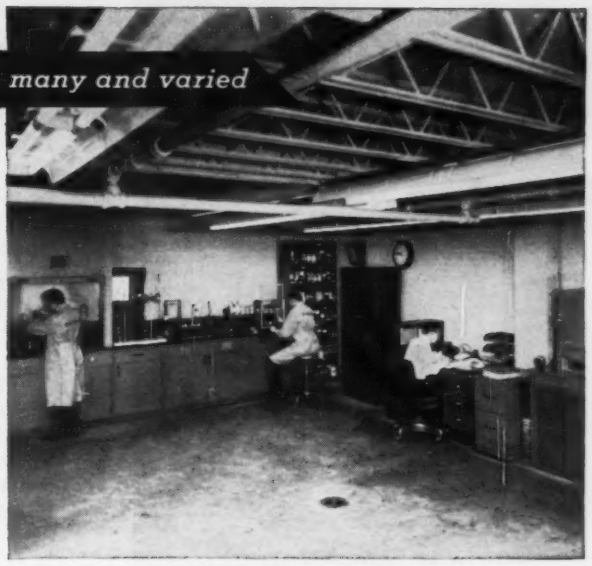


***PART OF THE CONTROL PANEL*** of Blackburn's recently completed current cycling laboratory. John A. Toedtman, Chief Engineer (left), and Ken Way, Vice President, observe tests in progress.

***NEW CURRENT CYCLING LABORATORY*** features virtually draftless air conditioning and a means of closely controlling ambient temperatures throughout the test area. Control of these factors permits truly precision testing of connectors. This photo shows Blackburn laboratory technicians taking resistance and temperature measurements of test connections. These new facilities permit testing of more than 500 connectors simultaneously. Advanced testing facilities like these enable Blackburn to provide you with the proper fitting for every operating condition.

*. . . and the tests are many and varied*

***THE GENERAL LABORATORY,*** a portion of which is shown here, is the scene of a great variety of tests. Hardness, yield and breaking strength of parts such as castings, bolts, etc., are determined. Special equipment is available for pull-out or holding force evaluation of all fittings. Clamping force measurements giving the relationship between tightening torque and the force exerted by the connector on the conductor are made here. Microscopic examinations and special electrical resistance measurements are routine. Tests like these give Blackburn fittings great dependability.



***THE CHEMICAL LABORATORY*** is the center for tests to control various chemical process solutions used in production. Electroplating, etching, and metal cleaning solutions are regularly tested here. In addition, special surface treatments are evaluated for friction control and corrosion protection. Thus, this laboratory assures continuous control of quality.

***SALT FOG CHAMBER,*** where tests may continue for hundreds or even thousands of hours. Here salt fog tests are made on wire connections. Test conditions are made in accordance with ASTM specifications. Electrical resistance measurements and visual observations are recorded at regular intervals during the tests.

***OUTDOOR EXPOSURE RACKS*** permit long-term exposure tests which often yield valuable information on weathering resistance not accurately obtainable from more highly accelerated tests. Specimens on these racks generally remain on test for at least a ten-year period.

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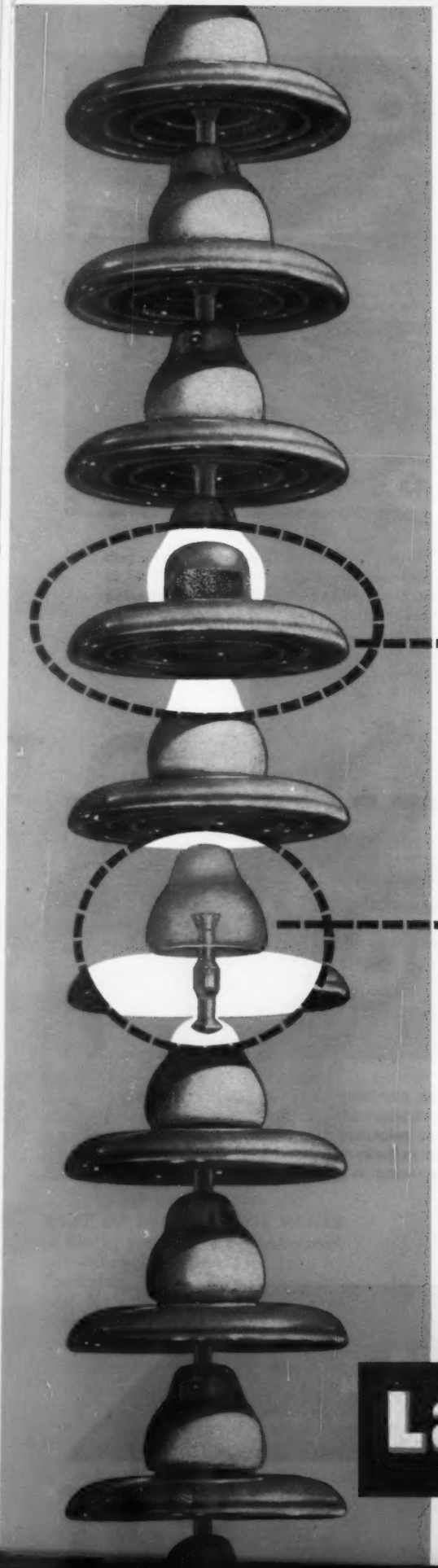

## GOT AN INSULATOR CORROSION PROBLEM?

Competent transmission system design calls for selection of components matched to each other in useful-life-expectancy. It often is the case, in areas of salt spray and/or industrial contamination, that rusting out of suspension insulators may be the first sign of a line "wearing out"—years before conductors or structures are in need of replacement. For such lines now being constructed or planned, the need for high-line maintenance or future reinsulation—and its high cost in skilled labor, transportation, and materials—can be avoided. Lapp suspension insulators are available, on specification, with cap and bolt components in a variety of corrosion-resistant alloys. We now have a lot of test data and installation records to help us, and you, to predict performance of these metal parts over periods of varying conditions of weather, concentration of corrosive action, prevalence of contamination, leakage currents and corona. Ask your Lapp representative about it—or write direct to us.

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Lapp vacuum process porcelain, with balanced compression-glaze "fit," has been proved—over millions of pieces, in thousands of shapes—the "most dependable insulation material on any system." Suspension discs are offered in standard (15,000-lb.) strength, high (25,000-lb.) strength, and heavy-duty shells. Fog-type units in same standard and high strength ratings, for either 5¾" or 6½" spacing.

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**MALLEABLE IRON** for caps only. Hot-dip galvanized, it is approximately equivalent to standard forged steel in corrosion resistance.

**LOW-ALLOY STEEL** hot-dip galvanized. For caps and bolts. Offers four to six times greater resistance to corrosion than forged steel. Nominal price premium.

**DUCTILE NI-RESIST** for caps only. Considerably lower in cost than stainless, is second only to stainless in resistance to most forms of atmospheric corrosion.

**STAINLESS STEEL** has highest resistance to corrosion of any material. Used principally for bolts, can be furnished for caps where severity of operating conditions justify the cost.

**ALUMINUM-SILICON-BRONZE** for caps and bolts under special chemical atmospheres where its resistance exceeds that of stainless.

**Lapp**

Lapp Insulator Co., Inc., LeRoy, New York.

# One Battle We're Losing —And Why

*Lest it seem self-serving, we of McGraw-Hill, as publishers, have hesitated to make the following statement about the "Battle of the Books." However, our reticence has been overcome by our conviction that it is greatly in the national interest to have much wider public understanding of the nature of this battle. This conviction is strengthened by the fact that many, not in the publishing industry, believe in the importance of this battle and, further, by the fact that it is a battle which the United States is losing.*

**The United States is losing an important battle — a battle of knowledge and ideas, waged with books.** It does not have the excitement of competition in scientific achievement, nor the urgency of a diplomatic crisis, nor the obvious economic significance of a struggle for export markets. But our success or failure in this battle of knowledge and ideas may well have a decisive bearing on these more spectacular aspects of international rivalry.

The Russians know this. About a decade ago, they started a program to build up their export of books, the most durable and penetrating way of communicating knowledge and ideas. **By 1957 the Soviet Union was exporting 30 million books, one-and-a half times as many as the United States.** Many of these books are printed in English, and all are in languages of the non-Communist world.

In the languages of the Near East alone, the Russians printed and distributed 413,600 books in 1957, as compared with 166,415 in 1956. In India, Russian textbooks on engineering are to be published in English under a technical aid agreement signed in Moscow last December.

## "Trade Follows The Book"

**Books are in the advance guard of the Soviet political and economic challenge to the free world.** With books go ways of thinking — about government, about education, about management, about science and technology. If these books do their job effectively in the training of those who will become a nation's leaders, they will provide the basis for political and cultural understanding and also, in the future, for trade.

The Russians are not the first to discover this relationship. Britain, which lives by trade, has traditionally exported more of its book production than any other nation. Today it exports one book in every two produced. The British have a favorite dictum: "Trade follows the book." They have proved its accuracy. Now the Russians are trying to make this same principle serve their purposes.

Where does the United States stand in this competition for men's minds? In number of books, it trails far behind the Soviet Union — exporting roughly 20 million books, against the Russians' 30 million. As a proportion of our total output of books, our exports amount to only 10% — against Britain's 50%.

## The Russians' Advantage

U.S. book exports have grown in the years since World War II, from approximately $11,000,000 in 1946 to $35,000,000 in 1958 (both figures excluding Canada). But in expanding book exports, the American publishing industry faces two major obstacles:

(1) **The comparatively high cost of producing a book in the United States,** which puts its price well beyond the reach of many students, teachers and businessmen in other countries; and

(2) **The shortage of dollar exchange in many countries,** which means that importers can pay for

books only in currencies that are of little use to American publishers.

The Russians have neither of these problems. Soviet publishing is state-subsidized, and exported books are sold for nominal sums paid in the currencies of the importers. As these books serve the political and economic purposes of the Soviet Union, they are cheerfully sold on giveaway terms.

**The American publishing industry, on its own, is making vigorous efforts to increase the distribution of American books in other countries.** Leading U.S. publishers and their agents have offices and salesmen in the major countries of Asia, Africa and Latin America. Several publishers have begun to reprint textbooks in Asia at one-half to one-third of their U.S. costs, thus making them available to the students in Asian countries at prices they can more nearly afford. And the American paperback has become a symbol of low cost in popular books. But neither of these devices is practicable for serious cultural, technical, scientific, educational and professional books, which require durable, hard-bound and necessarily expensive editions. Despite their great importance to those who need these books, the demand for them is simply not large enough to warrant low-cost publishing methods.

Government agencies also have increased the availability of American books. The United States Information Agency and the International Cooperation Administration have placed American books in libraries overseas, donated them to educational institutions and presented them to key individuals in the industries and governments of the developing countries of the world. But these programs are small in relation to the need.

## A Modest Program

**An unusual and little-publicized Government program has helped American publishers overcome the other major obstacle to the export of books — the shortage of dollar exchange.** This is the Informational Media Guaranty (IMG) program, administered by the United States Information Agency. It enables publishers of books judged to be worthy of the American way of life to sell their books, for local currency, in countries such as the Philippines, Formosa, Vietnam, Burma, Indonesia, Pakistan, Turkey, Israel, Poland, Yugoslavia, Spain and Chile, which would otherwise be unable to buy these books because of their shortage of U.S. dollar exchange.

**The IMG program is not a giveaway.** Publishers have to **sell** their books, and customers overseas have to want them enough to **buy** them at full prices. IMG merely guarantees that the exporting publisher receives in dollars the payments he collects from his customers in their currency. The program costs very little in terms of our total foreign aid program, or in terms of what it accomplishes. In ten years it has made possible the sale of $150 million worth of books, magazines and films to countries of key economic and strategic importance at a cost of only $10 million.

The IMG functions through a revolving fund. Foreign currencies are exchanged for dollars, and the foreign currencies in turn are resold to replenish the supply of dollars. The net cost is the small but unavoidable loss on resale of these foreign currencies. Over the ten years of this program, the IMG revolving fund has shrunk from its original $28 million to $18 million, $10 million of which is in unconverted foreign currencies.

**If this modest but vitally important program is to be continued, Congress must appropriate the money necessary to rebuild the revolving fund.** This would ensure that any country approved by the State Department and willing to sign an agreement to buy American books, at their full price, with its own currency, could do so. Last August, Congress reduced a requested appropriation for this purpose from $7 million to $2½ million. To continue even at its present reduced level, an appropriation of $3½ million is needed. To realize the full potential of IMG, the revolving fund must be restored to its original level.

If the IMG program is not continued, with adequate financial support, some countries whose friendship and understanding we seek today and with whom we hope to build a trading partnership in the future will have to reduce their purchases of American books to a trickle. These are countries where school teachers, college professors, students, engineers, doctors and businessmen need and want to buy American books. The loss will be not only theirs, but ours as well. For it will deprive the U.S. of one of its most effective, and least costly, means of communicating knowledge and ideas and understanding of the American way of life.

*This message is presented by the McGraw-Hill Publishing Company to help increase public knowledge and understanding of an important national problem. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.*

Donald C. McGraw

PRESIDENT

**McGRAW-HILL PUBLISHING COMPANY, INC.**

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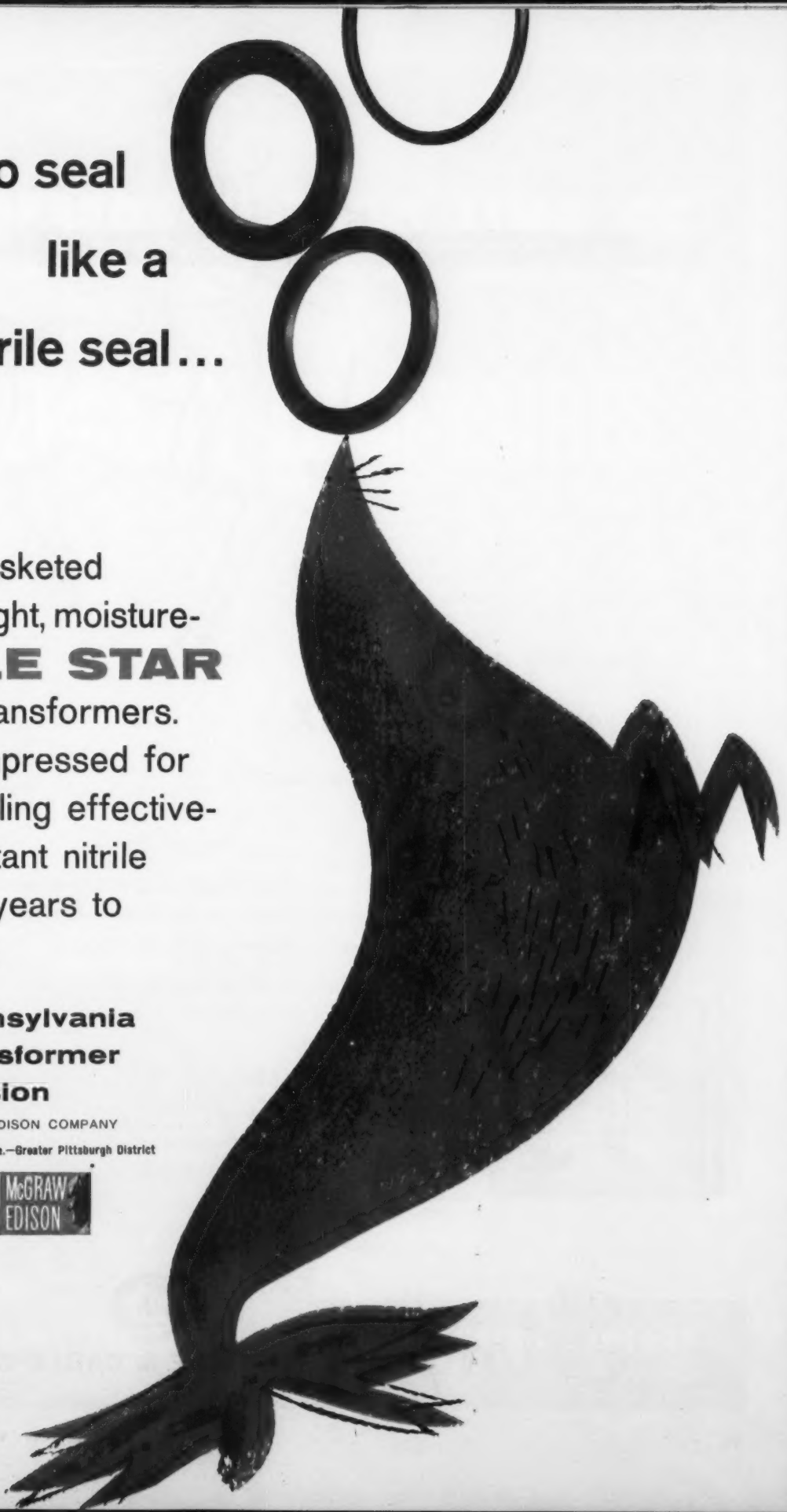

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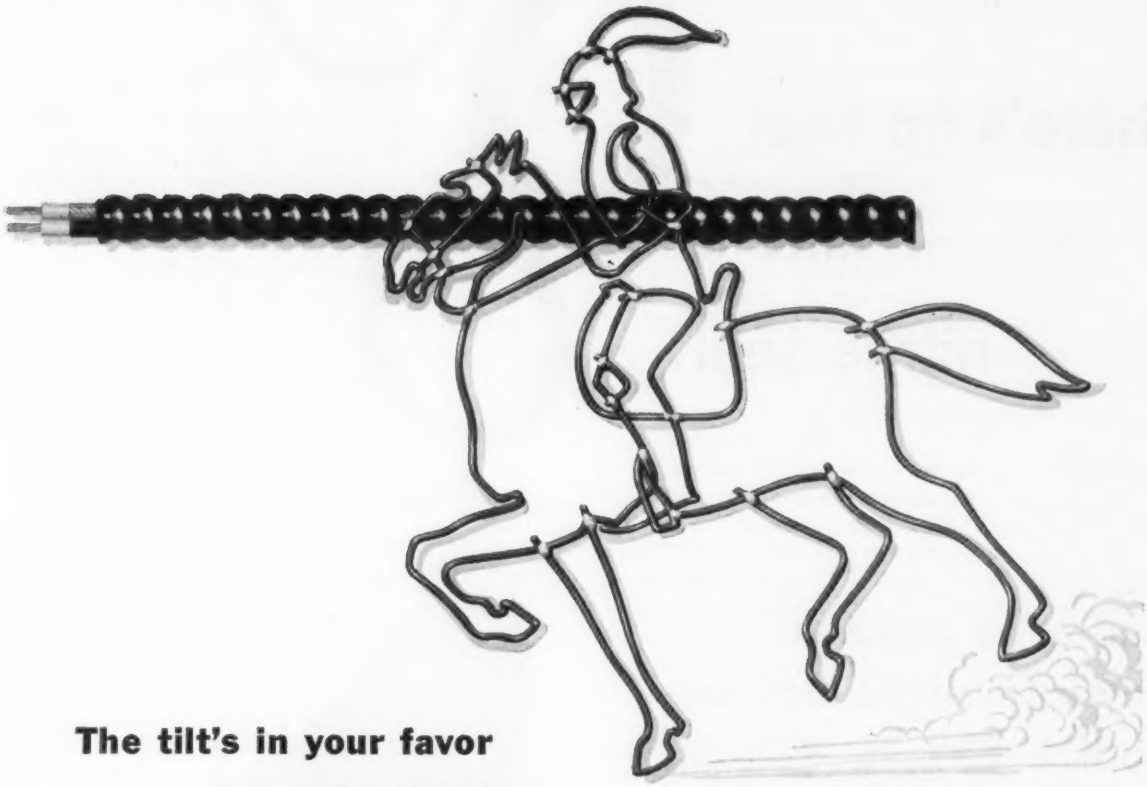

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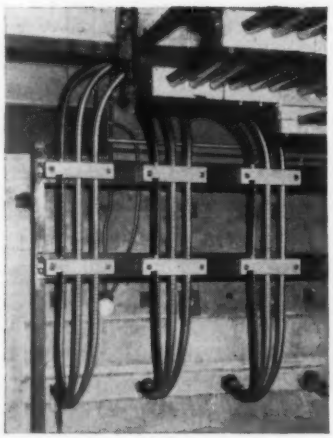

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# Editorial Comment

JUNE 1, 1959

## What Happened to the Big Reactors?

Completely missing from the atomic power construction bill that went to the Joint Committee on Atomic Energy for approval late last month was any project tied to the four recently-completed design studies for reactors in the 200 to 300 Mw range of the boiling water, pressurized water, heavy water, or organic cooled types.

Industry observers see in this signs that AEC Chairman J. A. McCone has won his fight to limit the government's role to the construction or encouragement of reactors in the intermediate-size prototype range, leaving the larger plants wholly to private industry.

There are two possible explanations that account for passing over the recommendations of the four "big reactor" study teams; one of them is political, the other economic.

On the political front it is recognized that there has been a change in the Washington atmosphere since last year. Worry over the recession has gradually changed to worry over inflation. President Eisenhower has put Congress on notice that he will veto bills which seriously challenge his balance-the-budget philosophy.

But perhaps more important is the economic answer given by AEC for rejecting the big-reactor design study recommendations. The Commission said: None of the four "is likely to be competitive with conventional units of the same capacity" in any area of the United States where such large units could be used. The Commission concludes, moreover, that no "major difference in the cost of power" can be expected from one of the concepts over the other, except that the heavy water plant would run an estimated one mill per kwhr higher than the others. A cost differential of one mill per kwhr is probable between conventional power and the boiling water, pressurized water and organic cooled plants.

Certainly the need for big power reactors from a strictly competitive view point is a long way off. AEC's economic reasoning emphasizes this point unmistakably and in a manner that no one in Congress or out can afford to overlook.

## Biggest City Goes Out of Power Business

Our congratulations to Con Edison for successfully negotiating the purchase of three city-owned power plants in New York City.

It would be difficult to conceive of negotiations more fraught with tedious political implications. The negotiations involved the effect of the sale on subway fares and drew opposition from the subway employees union.

Yet with patience and a business-like approach, Con Edison went about its offers and counter offers. The utility won the support of five of the six major newspapers in the City.

At the contract signing last month, Con Edison appeared also to have general public endorsement of its action.

# States Seek Clear Defined

**Criticized for inattention to radiation hazards, the AEC proposes bill to transfer some authority to states when they're ready to assume the responsibility**

**Chamber of Commerce urges that major control—including, ultimately, atomic reactors—should be state function**

**Public Health Service says it possesses the organization, both local and federal, to enforce health regulations**

The complex question of federal vs state control over atomic energy has been getting a hearing in Congress. And representatives of industry, labor and public health organizations have clashed openly.

- A United Auto Workers spokesman, atomic energy expert Leo Goodman, charged the Atomic Energy Commission with trying to "abdicate its responsibility." Members of the Joint Committee on Atomic Energy, which is conducting the hearings, have also criticized the AEC for not paying enough attention to the hazards of radiation.
- The Chamber of Commerce, on the other hand, claimed that a major portion of control, eventually including even jurisdiction over atomic reactors, should be turned over to the states.
- The AEC itself, prompted by general states' rights feelings, made the first move to shift some of the control to the states. A bill proposed by the AEC would give states authority to regulate the use of nuclear materials and radioactive by-products for industry and medicine—when they are ready to assume the responsibility. Some critics assert this time will never come.

The U. S. Chamber of Commerce said peaceful uses of atomic energy should be turned over to the states and that state control eventually should include control over power reactors. This was billed as the best way to foster industrial development of atomic energy.

The Chamber spokesman, William A. McAdams of General Electric Co, said states should have control over dumping of atomic waste within their own borders. The AEC, he said, should be limited to disposal of wastes in the ocean or of concentrated wastes that might "go critical" and explode.

When asked about dumping of radioactive wastes into streams that cross state lines, McAdams said the states and regions could handle that problem. "If they don't accept the responsibility," he said, "the federal government can then step in and take over."

One example of polluted streams that had been brought to the committee's attention was the dumping of waste uranium ore processing mills into the Animus River in Colorado which flows into New Mexico.

### Scientists Uncertain on Limits

The chairman of the National Advisory Committee on radiology which now sets "permissible limits," Bureau of Standards official Lauristan S. Taylor, testified that scientists aren't really sure how much radioactivity is tolerable. Current fallout, while insignificant, could be a cause for "serious worry" in the future if the current rate of increase continues.

Where federal authority stops and state authority begins has never been clearly established. Some states have moved right in and asserted what they believed to be their rights.

Minnesota, for instance, requires any nuclear installation to obtain a license from the state Public Health Department. This presumably would give Minnesota health officials inspection rights and veto power over U. S. atomic installations slated for that state, no matter how critical or super-secret.

New York State puts control over industrial equipment under the Labor Department instead of the Health Department.

State officials claim they need control over at least the health aspects of atomic energy because of the AEC's "conflict of interest" in both promoting atomic projects and looking out for public safety.

A Minnesota atomic official charged that the AEC will soon be pouring radioactive wastes from a new atomic power reactor on the Elk River into water sources that serve a million people.

And the health administrator of Idaho accused the commission of dumping radioactive wastes from its installation at Arco, Idaho, into underground streams without checking where the streams went.

The AEC's own inspection chief, Curtis A. Nelson, admitted that 44% of licensed users of nuclear materials violate safety regulations —5% of them dangerously so.

Rep Chet Holifield, top House member of the joint committee, noted that states have fallen down in one of the major areas where they now have control—the uranium mines. A Colorado health official admitted that mines have allowed workers to be exposed to 100 times the permissible limit of radiation and several times the

# Role on Control of Atomic Power

"working" limits adopted by seven mining states. Texas Health Director W. L. Wilson testified that the lack of clear-cut jurisdiction over radioactive hazards has caused dangerous sources to go unregulated by default.

Some members of the committee have yet to be convinced that the states are equipped to take on much responsibility at this point. Asked how many states are qualified to take on greater authority, AEC Commissioner John S. Graham said only that "several" could move forward rapidly if given a Congressional go-ahead. He said eight states already have "comprehensive" radiation safety regulations.

As a strong point in favor of more state control, however, state officials pointed out that 95% of the radiation hazard to the public comes not from atomic plants or fallout but from medical X-rays, industrial use of radio-isotopes, and natural radiation—areas in which the AEC has no jurisdiction.

### Health Service Makes a Bid

While the joint committee is trying to find a way to decentralize atomic control, another Senate group is considering a bill to invest "primary" authority over health aspects of atomic energy in the Public Health Service instead of the AEC. Sen Lister Hill's health subcommittee heard the arguments of health officers that they already have the organizational setup from the local to federal level to enforce health regulations. State health services have 200 to 250 trained radiation experts, compared to 45 in the AEC. Sen Hill agreed heartily with their assertions that they, and not the AEC or even an independent private group like the National Committee for Radiation Protection, are the logical agency to carry out extensive research on radiation hazards and set standards for permissible exposure.

Besides the two committees, the Administration also has a study going on to determine where control over health aspects should lie. The three groups will eventually have to get together, since health protection inevitably is tied in with who controls various aspects of the atomic program. The complexity of the jurisdictional questions probably means that no agreement will be reached for some months.

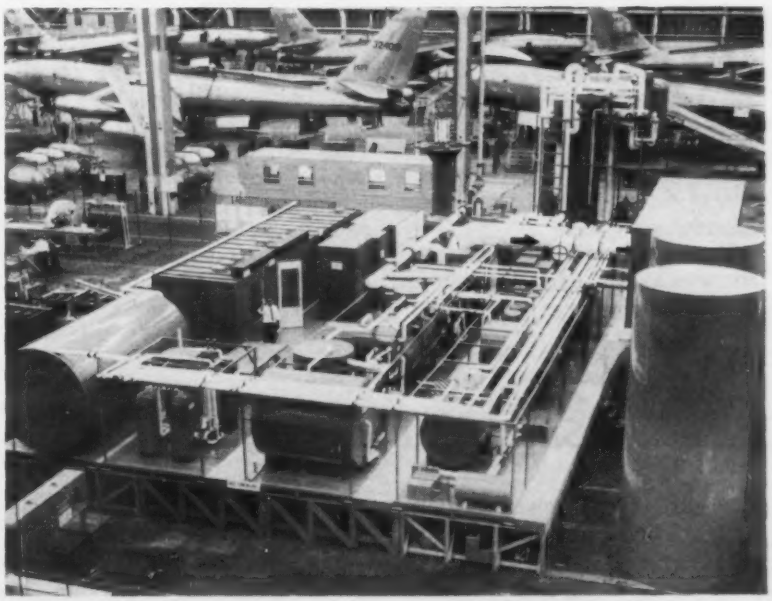
## Duquesne Light Reticent On 150-Mw Output Plan

Duquesne Light Co officials last week declined to reveal plans on a proposal by Adm Hyman Rickover to increase the capacity of the Shippingport Atomic Power Station to 150 Mw. The company executives are withholding an announcement until discussions with the Atomic Energy Commission have been completed.

It is understood, however, that a 100-Mw turbine generator had been installed with the initial core in anticipation that the plant output —or that of a subsequent core— would exceed the design of 68 Mw gross. The existing machine is regarded as inadequate for the 150-Mw gross output expected from installation of a new core, which the Joint Committee on Atomic Energy has tentatively authorized.

The committee's conditional approval includes provision of $5 million for a new core. The modification, however, is contingent upon agreement by Westinghouse Electric Corp and Duquesne Light to provide a turbine capable of producing the higher output.

Estimated cost of the turbine is $15 million.



## For Sale: 1-Mw Portable Nuclear Plant

If it can find the customers, Lockheed Aircraft Corp will stand to profit two ways on a proposed 1,000-kw pre-packaged nuclear power plant. The firm's nuclear products branch would produce the enriched-uranium fueled facility, shown in mock-up form above, then another division would airlift the plant to almost any remote region of the world within a day and a half or so. After completing foundation work at the site, it would take about three months to get ready for full operation, Lockheed claims. A prime application of the plant would be to tap mineral resources in areas lacking power.

# Ohio Retains 'RCN' for Rates

## Bill with 'original cost' formula is defeated; PUC will continue to use 'reproduction cost new' in fixing return

"Reproduction cost, new" will remain the formula for utility rate making in Ohio.

The Ohio House voted down the Democratic sponsored "original cost" formula bill to change the basis for rate setting by a vote of 80-53. Twenty-two Democrats teamed with a nearly solid bloc of House Republicans to defeat the bill. Only one Republican voted for it. Another bill which would change the rate base is under consideration in the Ohio Senate, but approval of the bill is not likely, informed sources say.

The defeated bill, which was written into the Democratic campaign platform, would have allowed the Public Utilities Commission to "give equal consideration and weight to the net investment in such property and to an appraisal of such property" or "original cost."

It would have replaced the provision that says utility property must be valued at the current replacement cost of the property, less depreciation, to determine a fair return for the company.

The 46-year old "RCN" formula has been a controversy in Ohio for years. Utilities maintain it allows them a fair return while providing low-cost service. Opponents of "RCN" maintained the bill would not have undermined utilities' fair return and would have allowed an even greater rate cut, without damaging Ohio's chances for industrial development.

Defeat of the "original cost" bill was the first in this legislative session of a bill written to carry through a campaign pledge of the Democratic party. It was the second defeat of an issue in the Ohio legislature in which Gov Michael V. Di Salle had personally intervened.

### Cities' League Sought Change

The Ohio Municipal League, representing the municipalities, demanded modernization of the rate base law to give their councils an improved position in rate negotiations with utilities. They argued Ohio is the only state in the nation with "RCN," and that such a restricted base hamstrings the PUC and makes costs of checking rate requests prohibitive.

Utilities countered by pointing out that Ohio's rates are among the lowest in the country, and although only Ohio has "RCN" on the books, it also imposes home rule.

Gov Di Salle, supposedly "irked" by the bill's defeat, later tempered his judgement. He noted that utility rate "reform" never before got that far in the legislature and that he is "pretty sure" rate requests in the next two years will be more temperate.

## Benson's REA Bank Plan Blasted by Sen Aiken

A "permanent financing plan" for rural electric cooperatives was proposed by Agriculture Secretary Ezra Taft Benson in a May 21 speech at Cedar Rapids, Iowa. Similar to one proposed last year by REA Administrator David Hamil, the plan calls for farmer-owned and operated credit banks on the order of the Farm Credit Administration.

Back in Washington, D. C., Sen George D. Aiken (R-Vt.), after learning of Benson's remarks, angrily accused the Eisenhower Administration of attempting to place farmers "under the thumbs of giant corporate interests."

Benson's plan would: **1.** "Authorize these rural systems to have their own bank—their own lending institution—which they may operate and ultimately own entirely." **2.** Have "their own national policy board to direct the affairs of their bank."

# Kefauver Says He'll Investigate Identical TVA Bids

Charges by the Tennessee Valley Authority that it has received identical bids from U. S. manufacturers for many of its equipment requirements has led to the probability of an investigation by Sen Estes Kefauver (D-Tenn.)

The situation probably will be brought before his judiciary subcommittee on antitrust and monopoly as another chapter in his series of hearings into "administered prices," Kefauver said.

Domestic makers of electrical equipment said that the items referred to by TVA are high-volume, production-line goods which carry list prices in their catalogs. The equipment includes small transformers, circuit breakers, disconnect switches, boiler tubing, insulators, lighting arresters and ACSR cable. About 47 U. S. firms have submitted identical bids on such items in the past three years, according to a Knoxville newspaper's survey.

Kefauver has asked his staff to get a full report on the charges from TVA Chairman Herbert Vogel. The senator points out that he thinks his antitrust subcommittee will "look with interest" into the agency's charges.

TVA decided to publicize the identical bids three weeks ago as a matter "of public interest and possibly of public concern."

## Private Power Approved

New York Public Service Commission has authorized Niagara Mohawk Power Corp to buy the Herkimer municipal system for $1,350,000. Brush, Colo., voters approved a 20-year franchise for Public Service Co of Colorado while rejecting a plan for a municipal electric system.

# Utilities Unbend a Bit at Stockholder Meetings

Stockholder meetings of power companies took on a bit more informality and originality this year, according to an informal EW survey. Although not prevalent enough to indicate a trend, the meetings included these sidelights:

Irrepressible McGregor Smith, board chairman of Florida Power & Light, gave a "Suwannee River" harmonica solo for shareowners who then approved a 2-for-1 split of 6.6-million shares of common stock. A 22¢-a-share dividend was declared. In answer to a question, Smith said a recent $2.8-million rate cut order would amount to only about 2% of operating revenues. The reduction is based on a fuel adjustment formula which factors in improved steam plant efficiencies and reduced line losses.

Atlantic City Electric Co was host to 30 high school senior class presidents at its annual session. In a pre-meeting briefing, John Lloyd, Jr, a director and ACE attorney, described the company's operations as "free enterprise in action." Bayard L. England, now ACE board chairman, told stockholders gross revenues increased 5% to $35.7 million and net income was up 13.7% to $5.9 million.

Toledo Edison Co's home service staff prepared and served coffee and rolls for the firm's morning session. Afterwards, stockholders had an opportunity to tour Bay Shore Station and have lunch on the company.

The most original move was noted overseas. In a 10,000-mi trip, Edgar H. Dixon carried the message of Middle South Utilities, Inc, the company he heads, to some 500 investors in Belgium, England, the Netherlands, Scotland and Switzerland. "It was well worth while," Dixon said. He estimated that 10% of MSU's stock is held in Europe.

At Commonwealth Edison Co's meeting, John W. Evers, president, summarized his feelings on the approach of his retirement this fall. "On the one hand, I am going to welcome the leisure and relaxation. . . . On the other, I will miss the stir and stimulation of daily office activity," he said. Chairman Willis Gale said overall reaction to the company's stock dividend plan was good. About 46,000 stockholders chose to sell their dividend stock, which garnered $1.02 per share. These owners, though, represented only 8% of the dividend. The new plan helped in boosting internal cash generation to about $78 million. On the economy front, Gale noted that only one stockholder objected to mailing of the annual report without an envelope. Savings in envelopes, postage and handling amounted to $4,000, he said.

**VISITING PRESIDENTS** of area's high school senior classes attended Atlantic City session, heard B. L. England, right

## POWER BRIEFS

**Area development** has become a subject of increasing utility interest in the post-recession period. Some recent highlights:

- Danville, Va., city council formally adopted a policy permitting Appalachian Power Co to serve all industry brought in through efforts of the company. The Danville Water, Gas & Electric Dept serves some 24,000 customers in the city.
- Steam generating plants should be built in Washington to assure firm power for industries, says P. A. Stack, bank executive and head of Puget Sound Area Development Council. The state needs to develop 40,000 jobs to support population increase expected in next ten years. Washington's chief challenge, he said, is to "outsell California."
- Pennsylvania Electric Co has launched a promotional and ad campaign to boost "Coaltricity", with special emphasis on space heating. By boosting electricity usage, Penelec's hard-hit soft-coal industry can regain its footing.
- An area development program has been created by Minnesota Power & Light Co. Howard W. Cooper, vp and assistant to the chairman, will head it up. The St. Lawrence Seaway and continued diversification of industry are two plus factors for the utility, which is headquartered in Duluth.

**Wage increases** in recent weeks include: Dallas Power & Light's one-year contract provides 5% hike and three-week vacations after 15 years service; Portland General Electric and Pacific Power & Light's one-year contracts grant workers 4.2%, increased medical and hospital coverage, and premium pay—based on seniority—for disabled employees shifted to lower rated jobs; Hawaiian Electric's two-year pact provides from 14 to 44¢ an hour for the contract period, boosting craft groups to a $1.48 to $3.12 range.

**Truck fleet color** may be changed from present "phone company" green at Consumers Power Co. Safety chief Bob Dohr notes post office traffic safety improved since red, white, blue has been used.

# Tax Assessment Fight Heads for Stalemate

## California boosts Pacific G&E's assessed valuation above $1 billion, while legislative committee calls for 50% ratio

On May 19 the California State Board of Equalization announced increases in the assessed valuation of Pacific Gas & Electric Co. The figure set by the board was $1,045,-918,000, an increase of $52 million over last year. This is expected to mean some $3 million in additional taxes in counties PG&E serves.

The tax raise, while not as large as the 1958 increase of $62 million, is of interest this year because of the controversy in the state legislature over assessment levels on utilities (EW, March 30, p 60). The tax increase also is indicative of a situation which poses problems for power companies in many states.

The California companies say they are being assessed at 50% of market value, while state-wide averages for locally assessed property is about 25%. A PG&E spokesman pointed out that the new assessment by the board is about half of book value, which would indicate the company's argument is valid.

Earlier in the month a legislative interim committee proposed a settlement of the assessment controversy. Following a two-year, $200,-000 study, the committee recommended a constitutional amendment to fix the ratio at 50% for electric, gas, and telephone companies and at 25% for common property and railroads.

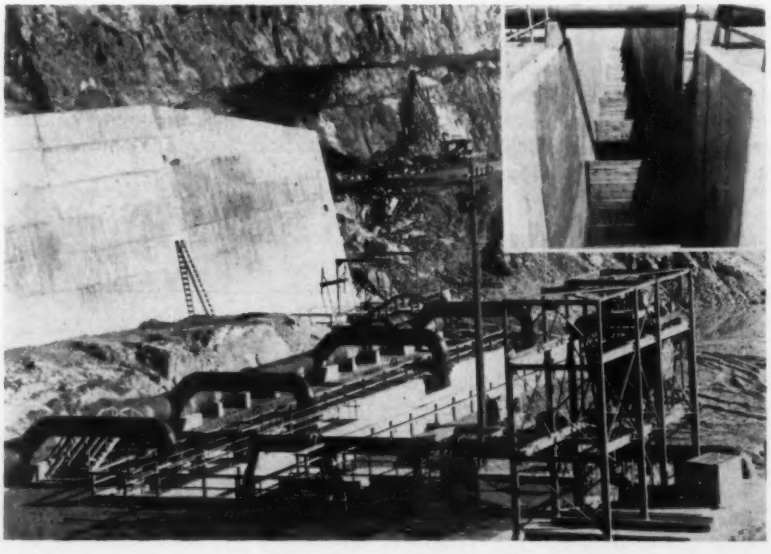
The proposal would submit the issue to a vote of the people to determine if the constitution should be changed. The committee action runs contrary to recommendations of hired consultants who advised a 30% ratio for both property types.

Two divergent pieces of legislation are pending in the California legislature on utility assessment rates, but it is considered doubtful if action will be taken this session.

In other tax developments, a bill to put a 10¢ levy on every utility pole in Florida has been introduced again. In past sessions, comparable bills never gained a floor vote.

A Pennsylvania bill to extend a new 3½% sales tax to electricity bills, repair and service charges; and utility maintenance equipment became law in mid-April.

A comparable South Carolina sales tax extension is expected to provide $1.6 million in revenue from 1960 electrical sales, based on a 3% levy. The measure will affect the state's power and gas companies as well as 24 REA co-ops and 23 municipal systems. The original appropriations bill included a 3% tax on industrial electricity sales, but this was deleted.



## Migrant Fish Get Boost With New Device

Idaho Power Co has completed another unique device as part of a $5-million system to help migrant salmon and steelhead get around IP dams in the Hells Canyon reach of the Snake River. Latest addition at Oxbow consists of channel-like fish "ladder" (inset) with step pools. The 15-ft rise up "steps" takes fish into collection trap and elevating hopper (right). Tank trucks transfer fish from hopper to upstream location above Brownlee Dam. The $800,000 network will operate whenever high water permits fish to get past another facility, already in operation, which cost $860,000.

## 'Crash Program' on Fish Migration Study Sought

Sen Warren Magnuson (D-Wash.) and six other Pacific Northwest senators have introduced new legislation calling for a "crash program for migratory fish studies."

The study would be to develop ways for "fish and power to live together" and thus "shorten the waiting period for needed new middle Snake River projects," commented Magnuson. He added that the Army Engineers, the Interior Department, and "agencies concerned with our maintenance of our fish runs" had requested the investigations.

The fish study would be conducted by the Army Engineers and the Interior in conjunction with the states of Montana, Oregon, Washington, and Idaho.

"Every effort will be made to obtain $700,000 for fiscal year 1960 and a continuing appropriation of $1 million annually until the study is completed and a solution found," Magnuson said. He also said that he felt "Congress will act expeditiously to inaugurate this extensive study."

# Says Unions Imperil Price Line

## Utah P&L president warns NELPA industry can't restrain surges without full cooperation of labor organizations

Labor unions, unless they practice self-restraint in their wage demands, could price their industries and themselves out of the market, the annual Engineering & Operation Conference of the Northwest Electric Light & Power Association was told at Salt Lake City, Utah.

Only with the unions' full cooperation can industry hold the overall price line, said E. M. Naughton, Utah Power & Light Co president. Until recently, he said, American automobile manufacturers ignored foreign competition, but now they are at grips with the problem posed by increasing import penetration. Similar situations, he said, are spreading into other fields.

The electrical industry today occupies a "gray zone" between first and second generations of computer application, said J. K. Dillard, Westinghouse Electric Corp. The "first generation" placed emphasis only on decreasing solution times, ignoring the complete revision of fundamental problem logic which can revolutionize computer use.

But the industry now is applying dramatic new mathematical techniques which can further optimize use of computer speed and economy, said Dillard.

Operational gaming methods, for instance, are applied to a New Jersey utility system represented in digital computer memory, he said. These techniques combine the chance events on the system with load growth projections and operating and engineering criteria selected by utility personnel. About 100 system expansion alternates will be run through "simulation games" in which 20 years of operation are compressed into 20 min of computer time. Present-worth economic comparisons will be made to determine the best, Dillard stated.

Utility engineers must react to sales departments' assistance requests with "can-do" rather than a "show-me" attitudes, said G. M. Brunzell, Washington Water Power Co. Engineers' aid must be active and sympathetic because sales activities provide the dollar income for utility survival, he said.

Development projects like General Electric Co's extra-high-voltage project are programmed far enough ahead of utility procurement of 460 and 650-kv apparatus to assure fully investigated designs, said Dr. P. Abetti. The underlying philosophy is diametrically opposite to that which controlled engineering for 345-kv apparatus, he said, explaining that manufacturers then took orders before completion of optimum designs and had to deliver without complete determinations.

### Considered Prototype

Discovery that a transmission line fault projects traveling waves to the breaker immediately following interruption has influenced high-voltage interrupter design, said R. B. Shores, General Electric Co. A high thermal capacity resistor paralleling each break of new air-blast circuit breakers was found necessary to decrease magnitude and rate of rise of traveling waves at the breaker, and the ohmic value is lower than would have been predicted from study of source-side conditions alone, he said.

The 40-eMw nuclear plant projected for Philadelphia Electric Co and High Temperature Reactor Development Associates is the minimum size permitting reasonable neutron economy in that compact-core type, said Dr. F. De Hoffmann, General Atomic, but the design, he said, can be easily scaled up. Preliminary designs for plants up to 325 eMw have projected 7-7.5 mills per kwhr total energy cost, so that the HTRDA plant must be considered a prototype rather than a cost yardstick, he said.

Today's 300-Mva high-voltage transformer weighs 500,000 lbs, the same as 1925's 60-Mva, a dramatic illustration of recent design advances, such as inner-cooling, said C. W. Mills, Westinghouse. Despite much smaller physical size per kva, losses have dropped at least 50%, he said. Vapor-cooling by fluorocarbon heat transfer media is being developed, the non-toxic, non-explosive, flame-proof, and thermally stable fluorocarbons giving promise of use in congested areas.

Engineering salary determinations should relate to work difficulty and quality rather than to average salaries taken from maturity curves, said R. D. Gray, California Institute of Technology. While not advocating full salary disclosure, he said that employee knowledge of salary brackets for specific jobs can be a tremendous incentive. Utilities still maintain the "myth of salary secrecy" on middle-bracket engineers though union contracts reveal compensation of covered employees and that of top officials is known.

An electric heat job at an Oregon school was metered for a year to segregate space heating from total load, said W. A. Dunn, Pacific Power & Light Co. Total connected load of the 450-student, 55,000-sq-ft school was 1,043 kw, of which 674 was space heating. Space heating usage, estimated at 435,000 kwhr, ran 445,000. Typical monthly heating load factor was 23 vs 26% for total load. Comments from school officials and teachers generally were favorable, he said.

Space heating saturations in the Pacific Northwest were examined by a panel which found company values ranging from 21.9% to negligible. Overall, active promotion was reported growing, although in most cases slowly. High saturations were reported frequently where no active promotion exists. Heavy commercial heat pump load growth was reported in several areas.

Closed-circuit TV and supervisory control via microwave will be used in the operation of the 190-Mw Oxbow hydro plant from Brownlee, 12 miles away, said T. R. Heikes, Idaho Power Co. TV makes possible many more indications than other means. Switchboard indicating instruments and cyclometer counters operated from integrating wattmeters and varmeters have numbers large enough to be read on the TV screen. Rack-mounted cameras in front of the panels will be positioned by supervisory control, Heikes said.

# Underground System Costs Pared for

## Plastic conduits and polyethylene-insulated primary cables cut Arizona PS installation costs at new home area

R. T. **FRYER**, Consulting Engineer, Arizona Public Service Co, Phoenix, Ariz.

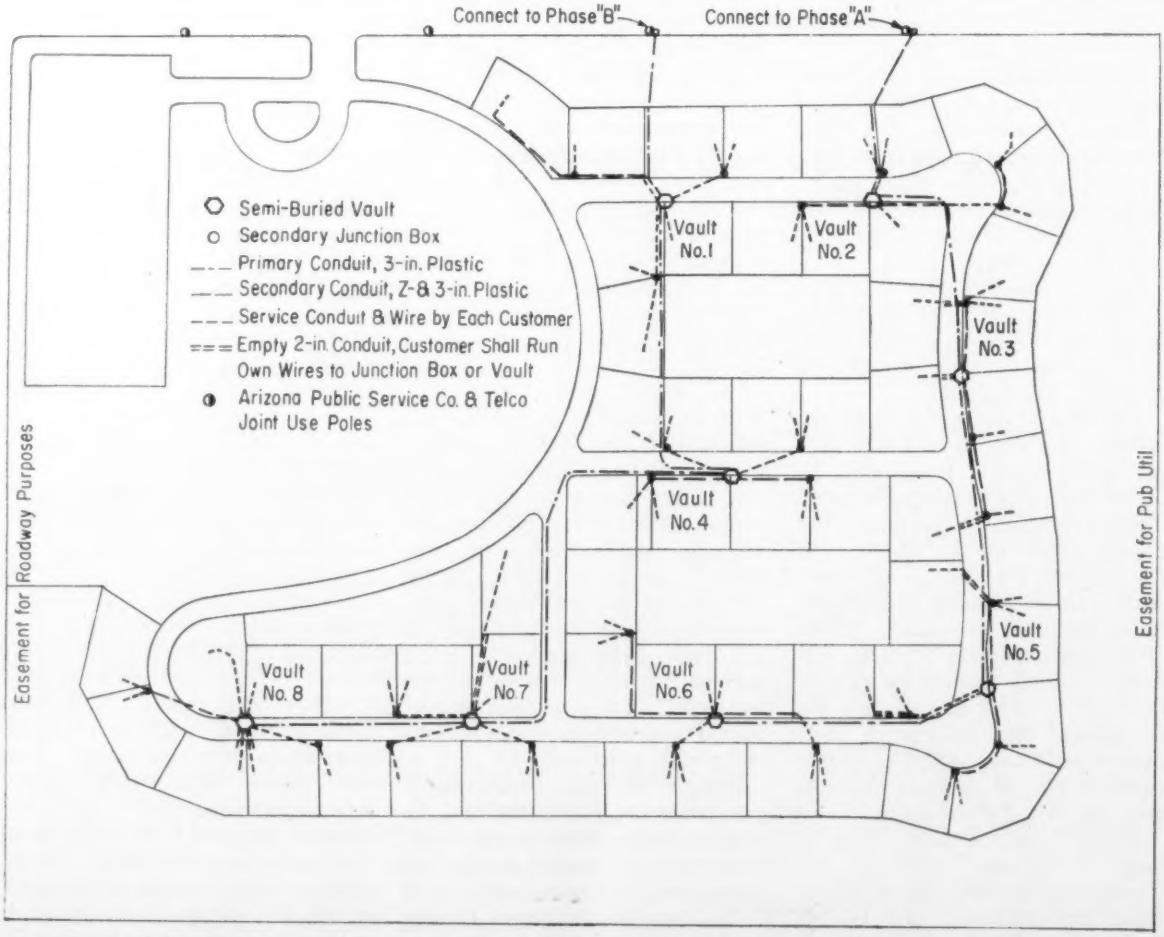
Plastic conduits and polyethylene-insulated primary cables achieved costs competitive with those of a direct buried primary system in Arizona's Mountain Shadow Resort residential area.

This was accomplished through the lower installation costs of the plastic conduit, only 10-15% of what it costs to install conventional underground conduit, together with the far lower price of the polyethylene insulated cables.

Mountain Shadow Resort's 59 $32,000-40,000, 2,000-3,000-sq-ft homes are typical of modern high-class, ranch-type subdivision developments. With no alleys, utility supply systems are restricted to the street side. The developer and the utilities decided on underground systems to eliminate exposed equipment incongruous with the subdued living theme.

Based on cost studies, a 7.2-kv primary system, fed at two points from different phases of a nearby 12.5-kv overhead system, was selected. Two single-phase underground radials supply four semi-buried vaults each. Two supply sources and no sectionalizing was found to be cheaper than one source with sectionalizing.

Two factors steered Arizona Public Service away from a direct-buried cable job. First, the utility wanted a system for encompassing major increases in capacity without heavy excavation and extended outages. The selected 7.2-kv conduit-installed cables can carry up to 2.5 times the present demand and when the load increases beyond their capacity, the system can be converted to 12 kv at nominal increased cost in order to provide 73% more capability without excavation. Secondly, maintenance of direct-buried cable has been costly.


Connect to Phase "B"
Connect to Phase "A"
Semi-Buried Vault
Secondary Junction Box
Primary Conduit, 3-in. Plastic
Secondary Conduit, 2-& 3-in. Plastic
Service Conduit & Wire by Each Customer
Empty 2-in. Conduit, Customer Shall Run Own Wires to Junction Box or Vault
Arizona Public Service Co. & Telco Joint Use Poles
Vault No. 1
Vault No. 2
Vault No. 3
Vault No. 4
Vault No. 5
Vault No. 6
Vault No. 7
Vault No. 8
Easement for Roadway Purposes
Easement for Pub Util

**UNDERGROUND RADIALS** each supply four semi-buried vaults. Typical of today's high-grade residential areas in many respects, Mountain Shadow Resort, Arizona, has no alleys, and utility equipment is not permitted to be eyesores

# Residential Service

A duct system once selected, the problem was to get a primary conduit job at direct-cable-burial prices. Type II (direct-burial) conduit had to be used. Concrete encasement would have incurred additional expense to prevent conduit from floating in fresh concrete, as installing tie cord anchors in the practically impenetrable caliche soil is difficult.

Checking available Type II conduits, the utility found the plastics to have numerous merits. For instance, 2-in. extruded styrene conduit is 35 lb per 100 ft, and 3-in. 55 lb, compared to 350 and 500 lb for other types. Two men can easily handle 200 ft at a time. Arizona PS procured it in 30-ft lengths, as such lengths included fewer joints. As it is somewhat flexible, it can be joined outside of the trench and laid like direct-burial cable.

This flexibility permitted a 90-deg field bend on a 9-ft radius, eliminating factory bends. With this radius, considered a straight section for cable pulling purposes, pulling was much easier, most of the force normally needed being applied to bend the cable for a 24 or 36-in. bend and to straighten it thereafter.

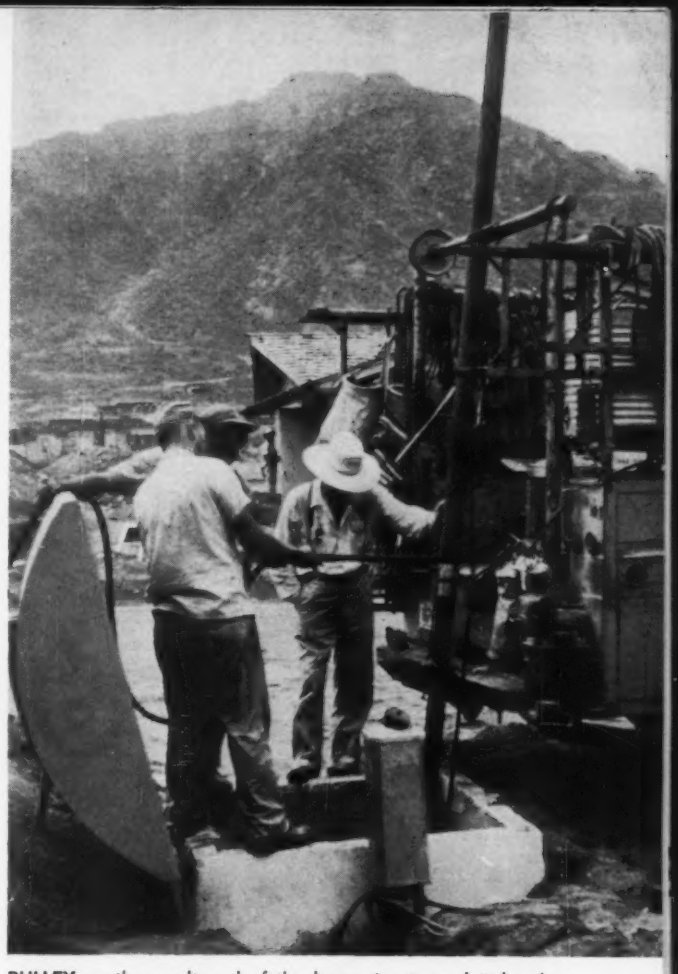
Contractors estimated 2 and 3-in. plastic pipe lay at 7½¢ per ft. On one job, 4,000 ft of 2-in. plastic water pipe was laid in an 8-hr day by three men. This amounted to about 3¢ per ft.

Plastic 2 and 3-in. conduit varies in price from competitive to many times that of other material. In future, when practicable, the utility will use 2½-in. plastic conduit. Above 3-in., other conduit is much cheaper because of the high extrusion pressures required for the plastic type. Plastic conduit use simply reduced installation costs. With further use, perhaps the conduit itself will be cheaper than other types.

The primary conduits were laid in a 51-in. deep by 18-in. wide trench and were covered with 10 in. of fine earth water-soaked to reduce expansion and obtain compaction. Over this covering, a ready-mixed concrete protective cap about 2-in. thick was poured for the width of the trench. After the concrete had set, the trench was backfilled to 30-in. depth for secondary power conduits and telephone cables. Telephone company cables were placed 12 in. from power conduits in inside positions. The plastic secondary conduits again were covered with fine earth backfill and water-soaked. Final backfill was by machinery. On future installations the trench will be only 42-in. deep.

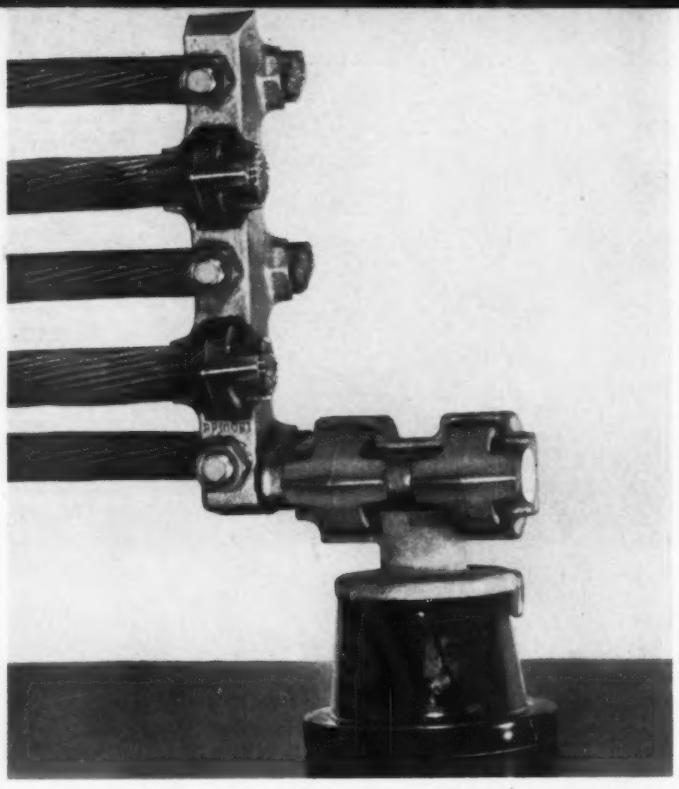
On the objectionable side, plastic conduit expands with temperature, and this particular installation had to be made during the year's hottest days. At the worst part of the day, temperature approached 140F in the open and at night dropped to the mid-80's. This temperature differential created a 2-to-3-ft variation in the longer runs.

At first, the conduit was snaked in the trench to allow for contraction. After discarding this tedious procedure, the company laid the conduit straight, leaving about 1-ft excess at each end. The morning after laying, joints were checked, and the conduit was backfilled and soaked and the cap was poured to prevent further conduit thermal changes.



**PULLEY** on the vault-end of the boom is at conduit level to guide winch line. Rope was used to preserve plastic ducts

**PLASTIC CONDUIT** is laid on the trench floor, and the semi-buried transformer vault protrudes only 18-in. above grade



**TERMINAL ADAPTER** for secondary bushing allows three to six cable connections and facilitates disconnections

Solvent cement was applied to the joints only on the conduit end, not on the coupling. Otherwise, excess cement would partially block the conduit.

Selection of primary cable was based on cost per conductor amp-ft. On this basis, copper cables carry more amperes per dollar than aluminum at current prices. Accordingly, polyethylene-insulated PVC-jacket cable plus bare neutral was by far the cheapest. Cost difference compared with the rubber-insulated neoprene-jacket cable plus bare neutral, or with lead-covered cable plus a 600-v insulated neutral plus potheads, would more than pay for the conduit. Vault space for potheads was not available.

The primary selected was single-conductor No. 2 (for mechanical strength) AWG, 7-strand copper, 15-kv shielded, grounded-neutral, polyethylene-insulated, polyvinyl chloride jacketed underground cable. Specifications were: conductor Class B not coated per ASTM-8, special strand shielding, semi-conductor nylon tape, 0.220-in. nominal wall thickness high molecular-weight polyethylene, semi-conducting printed nylon tape applied with lapover polyethylene insulation, one 0.005-in. NT copper tape spirally applied with lap, 5/64-in. nominal wall special polyvinyl chloride type SA354 jacket.

The primary conduits, 51-in. below grade, enter transformer vaults from below at 20 or 30 deg to the horizontal. Special provision was devised to pull the cables into the vaults. An inverted boom with a pulley on its end was lined up directly in the vault with the conduit and supported against the rear of a winch-equipped truck. The manila pulling line passed over another pulley at winch level.

Secondary cables also were purchased on cost per amp-ft basis. Current carrying capability was based on manufacturer's recommended ratings. Type RHW, 600-v cable having a 90C conductor rating was used.

Direct-buried transformers were considered but rejected. Heat dissipation is still an unknown factor, and Arizona's alkali soil makes tank life doubtful. Moreover, additional cost of terminal chamber plus wiping sleeves and extra depth of hole for burial nearly equals the cost of the semi-buried vault selected. Accessibility of equipment favored semi-buried vaults.

The conduit system was laid out for a maximum of eight homes per vault, based on expected future demand of about 25 kw per home. Present connected load is 26.5, with a coincidental demand of 12.5 kw per house expected for eight houses, so that a 100-kva protected transformer was used, although a 167-kva unit can be accommodated.

Wherever possible, vaults are between two houses and serve them directly. Other houses are fed from secondary junction boxes. Generally, the boxes are between two houses which share a common line from vault to box. Most secondaries are nearer than 200 ft from the vault, so that flicker and drop problems are circumvented. Motors to 10 hp can be started with less than 5% drop with no increase in secondary cable size.

Vaults are rectangular precast concrete boxes with a 12-gage black iron hood for access. The box protrudes 6 in. above grade, having inside dimensions of 42 by 45 by 48 in. and 4-in walls. The primary conduits enter from below with a 20 to 30-deg bend or offset and the secondary conduits, 30 in. below grade, enter the vault side without bend.

### Vault Only 18 in. Above Grade

The rainbow-shaped vault hoods have a 2-in. air space between outside dimensions of the vault box and the hood. At the hood's top, a 2 by 1-ft opening provides an air exit, covered with 14-gage ¼-in. perforated sheet metal shaped like 2-in. channel. A miniature hood covers the channel for tamper-proof protection.

Hoods were primed and painted with polyvinyl paint and blend in color with the neighborhood. The vault extends 18 in. above grade.

The company used 100-kva, 7,200-120/240-v, single-phase, protected pole-type transformers. For the slight cost difference, and considering vault space, mounting and connecting problems of other secondary de-energizing methods, no better and cheaper unit could be had.

A convenient, orderly method now exists, using a new terminal adapter, to connect three to six cables to each transformer secondary bushing. A faulted secondary cable can be disconnected quickly.

Company-owned secondary cables terminate in the secondary junction boxes, and the real estate developer pulls his own cables into the service entrance. The boxes are precast concrete, 12 by 24 by 18 in. inside with 2-in. top wall thickness. Boxes are mounted flush with grade. A ridge on the underside of the 2-in. cover concrete prevents the cover from moving off the box.

During construction, thermocouples were installed in primary and secondary conduits; on conduit external surfaces; in vault inlet and exit air paths; in transformer top oil; and for soil readings at various depths.

# Stainless Steel Paint Protects Towers

E. J. HIGGINS, Protective Coating Engineer, American Electric Power Service Corp, New York, N. Y.

A multi-pigment stainless steel paint has been thoroughly field tested and proved valuable. It was developed by the American Electric Power Service Corp for use on transmission towers and substation structures. Its main advantages are:

1. Extreme durability, showing almost no deterioration after eight years' exposure in corrosive atmospheres.
2. Ultra-smooth surface that sheds dirt and dust.
3. Mild, slow-chalking characteristic.
4. Excellent hiding power and brushing properties.
5. Long life expectancy of at least 12 years.

The development grew out of a suggestion to the writer in 1948 by a fabricator of stainless steel powder (18% Cr, 8% Ni) that it might be used as a pigment in protective coatings. Samples of stainless steel powder were sent to AEP's general laboratory. Several formulations were prepared by adding varying proportions of the powder to suitable vehicles secured from several paint manufacturers.

Panels coated with the formulations were subjected to exposure and weatherometer tests. Results indicated that these early formulations had inferior durability compared with our standard paints. This was due to poor leafing properties of the stainless steel powder, which resulted in voids in the paint film.

Research in testing and formulating the powder into a usable paint was extended by experimenting with mixtures of stainless steel powder and non-metallic pigments in synthetic resin vehicles. Samples of multi-pigment stainless steel paints prepared to AEP specifications were secured from several cooperating paint companies. They were applied in one coat to primed and unprimed clean steel and weathered galvanized angle irons. The angle irons were placed on exposure racks at Charleston and Wheeling, in locations where corrosive atmospheres prevail.

After two years exposure, results on the samples were so impressive that field tests were arranged in corrosive areas on the AEP system with the paint used as a finish coat on transmission towers. After eight years exposure, the towers painted with stainless steel look as good as new.

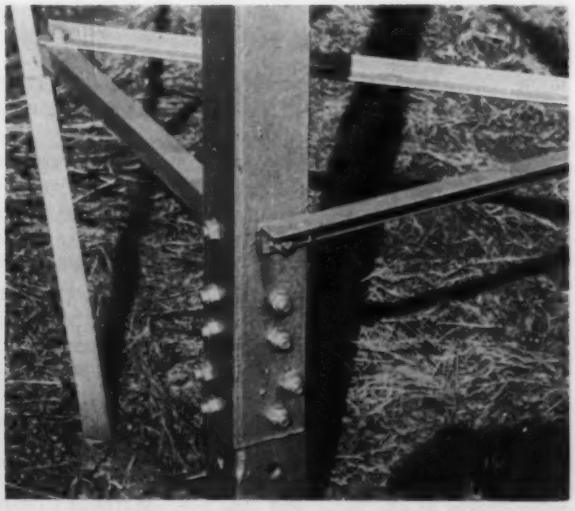
We are now extending our use of the stainless steel paint as a finish coat on structures exposed to corrosive atmospheres. Although it costs more than twice as much as standard structural gray finishes, substantial savings will result from its use. The additional years of life will reduce labor expenditures that represent more than 80% of total painting costs.

Based on the increase in life from 8 to 12 years, we expect to save about 30% on our annual cost of maintaining 138-kv towers exposed in corrosive areas. This saving will be further increased if the paint lasts longer than 12 years, which we expect it to.

One word of caution: The long life advantage of multi-pigment stainless steel paint can only be obtained when it is applied over properly primed surfaces. It should not be applied directly to bare metal.

The Debevoise Co of Brooklyn has worked closely with AEP and produced the first successful paint. Vita Var Corp, Newark, N. J., has also manufactured the paint. These and other paint companies are expected to offer it as a commercial product shortly.

**STANDARD** tower finish paint is showing definite signs of failure after eight years' exposure in corrosive atmosphere



**STAINLESS** tower finish eight years old maintains new appearance. Smooth surface helps keep tower dirt-free

## Tandem

Maneuverability in tight quarters is one of the features of a heavy-duty, lowbed trailer put into service by Pacific Gas & Electric Co to carry a 40-Mva, 220-110-60-kv mobile transformer. The semi-trailer and transformer combination weighs about 111,500 lb and rides on 32 wheels. Mobility of the unit will permit its use at 15 major substations scattered along the 400-mile length of the system.

DUKE POWER COMPANY
MATERIAL REQUEST and TRANSFER
ON
SYSTEM CENTRAL WAREHOUSE

NOTE: LIST REEL NUMBERS AND WEIGHTS ON REVERSE SIDE

TRANSFER NUMBER: MO. | YR. | LOC. 2509 | NO.

SHIP TO: DUKE POWER CO. C/O

LOCATION:

DO NOT FOLD

USE THIS FORM ONLY FOR MATERIALS SUPPLIED FROM SYSTEM CENTRAL WAREHOUSE

ORDER DATE | SHIP VIA | B/L OR S/N NO. | PREPAID | COLLECT | FREIGHT CHARGES | MATERIAL REQUEST NUMBER

FILLED BY | CHECKED BY | DATE SHIPPED | SEE BACK ORDER | BACK ORDERED FROM | POSTED BY | CREDIT ACCOUNT 2509 — 131.

ON HAND | BACK ORDER | QUANTITY ORDERED | DESCRIPTION (TYPE IN CAPITALS ONLY) | LOT NUMBER | QUANTITY SHIPPED | VALUE | DEBIT: LOC. | ACCOUNT NO

# New Form Aids Ordering of Material

**M. A. EDWARDS**, Stores Supervisor, Duke Power Co, Charlotte, N.C.

An eight-step procedure and Transfer Order Form for ordering material from the system warehouse saves manhours for Duke Power Co. Use of the procedure and form replaces an 18-step method and has reduced reproduction of forms from four to one. The form consists of an original and four carbons.

In addition to the direct saving, the simplified procedure has shortened the interval between preparation of the form and delivery of materials and supplies from two weeks to four working days. This reduction has, in turn, permitted inventory reduction.

Initially, the branch storekeeper prepares a pencil copy of the requisition showing exact lot numbers and description of items. His typist types six copies of the Transfer Order Form, checks against the pencil copy and returns the copies to the branch storekeeper.

He initials the original, retains the sixth copy and sends the first five to the branch manager for approval. The branch manager signs and sends the copies to Material Control.

Material Control checks requests against needs, obtains any necessary approvals, and sends the first four copies to Central Warehouse after listing the numbers. Material Control keeps Copy No. 5.

The Central Warehouse storekeeper ships material, sends the branch storeroom Nos. 1 and 4 copies, retains No. 3 for warehouse files, and sends No. 2 copy to Material Control. Material Control checks and forwards No. 2 copy to the Accounting Department as a tracer.

The branch storekeeper receives Nos. 1 and 4 copies, signs No. 1 as a receipt and sends it to the Accounting Department. He retains No. 4 for his files.

# Trailer Carries 40-Mva Mobile Transformer

The semi-trailer tandem unit, made by F.A.B. Mfg Co, was designed and engineered jointly by F.A.B., Bigge Drayage Co and PG&E engineers. Maneuverability of the 42x8-ft trailer is enhanced through use of a patented steering device which joins the front and rear units of the trailer. This device allows turning on a circle of 30-33 ft. Operating principle is based on a telescoping connecting tongue.

The 40-Mva transformer was held to a weight of 96,000 lb through substitution of aluminum members for steel wherever possible, use of a special grade of core steel, and design of the cooling system for minimum volume of coolant. The 32 wheels, each supporting 3,515 lb, are mounted in units of four on eight axles. F.A.B. Mfg Co reports that each axle has a quick detachment arrangement which allows a fast wheel or tire change.

The complete unit, powered by a highway tractor with semi-trailer fifth-wheel hook-up, is limited to a maximum highway speed of 30 mph. PG&E has an agreement with a local trucking company, which will provide the tractor and arrange hauling permits when the mobile unit is to be moved. Based on experience with this trailer, PG&E may acquire up to three more trailers.

# Tighten Washer-Head Nuts Easily

Washer-head nuts for H-frame structures are tightened more quickly and more effectively by Kansas Gas & Electric Co linemen using a take-up wrench made in the company shop.

The tool has a hook on one end that fits over the washer of the washer-head nut. A pipe is fitted over the handle end of the tool and tack-welded. The wrench provides high leverage, enabling linemen to tighten nuts more securely than could be done with ordinary wrenches.

# Waste Oil Helps Cut Brush Control Costs

**A. M. CULLEN,** Distribution Planner, Ohio Power Co, Lima, Ohio.

Using waste insulating oil as a vehicle in compounding a spray mixture for vegetation control cuts costs for Ohio Power Co. The waste oil is salvaged from scrap distribution transformers.

The spray solution, used in basal bark spraying, is composed of one part of brush killer (containing 4 lb acid equivalent of 2, 4-D and/or 2, 4, 5-T esters) added to 24 parts of oil. Either fuel oil, kerosene, or any similar oil may be used for the carrier.

The more expensive or special oils have no great advantages over ordinary used oils, providing that the latter do not contain sludge that will clog the spraying nozzles. Previously, No. 2 fuel oil had been used, at a cost of 15¢ per gallon.

Currently, Ohio Power Co can reclaim oil for 14.3¢ per gallon. New transil oil is 26¢ a gallon, so only 11.7¢ a gallon is saved by reclaiming. If this saving is given up, the greater saving of 15¢ a gallon fuel oil expense can be obtained.

# New Analytical Tools Permit

**New mathematical and computing tools allow analysis of intricate relationships entering into optimum system design and operation; permit evaluation of present worth of system costs for alternative plans of equal reliability**

L. K. **KIRCHMAYER**, Manager, System Generation Analytical Engineering

A. G. **MELLOR**, Senior Engineer, Power Generation Engineering General Electric Co, Schenectady, N. Y.

Today progress in the development of new analytical methods, tools and techniques has evolved a more sophisticated approach to system planning than in the early days of public utilities when only approximate methods of analysis were available. Then the emphasis in system planning was on the most urgent problem—making the system work properly. In the interim utilities have pioneered in the use of computers such as the a.c. network analyzer, as an aid in system planning studies. Now, new mathematical and computing tools let us recognize the intricate interrelationship of many factors both technical and economic, involved in an optimum pattern of system design and operation. This is the essence of integrated system planning.

Among the many steps in the development of the concept of integrated system planning, these stand out as having particular significance:

**1.** Growing acceptance of the principle of incremental loading of generating units to obtain better over-all system fuel economy. This step—from considering only the economic operation of individual units, to considering overall system economy—is also a major factor in integrated system planning.

**2.** Development of new methods to accurately evaluate transmission losses. This has not only resulted in more efficient operation of existing systems but also served as a guide in designing new transmission facilities, and in the location of new generating facilities.

**3.** Increased use of the present worth method of evaluating future costs. This provides a more realistic basis for considering the relative worth of alternate plans.

**4.** Development of mathematical methods which permit evaluation of the reliability of systems.

**5.** Availability of high speed digital computers which permit application of more sophisticated methods.

In spite of past progress we are faced today with problems of increasing complexity which require new concepts and new methods in system planning for their solution. Economic and technological changes are putting emphasis on even more intensified integrated system planning:

There has been a slowing down of technological improvement in some areas; particularly steam station heat rate. This requires a reappraisal of the types of generation that should be installed on power systems to obtain optimum economy and minimum power costs.

Relatively low cost gas turbine-generator units have become available which offer an economical new method of handling peak loads.

The prospect that large sized nuclear power plants may become economical within the next few years may change the pattern of power system generation, particularly in regard to base load generation.

Economical coordination of hydro and thermal sources of power is becoming increasingly important and at the same time more complex. This is particularly true where pumped storage hydro offers attractive possibilities.

Changing economic conditions will often make mouth-of-mine power plants with associated electric transportation of energy more economical.

**Table I—Data on Unit Outage Probability**

| Unit 1 | | Unit 2 | |
|---|---|---|---|
| Capacity Out Mw | Probability of Outage Occurrence | Capacity Out Mw | Probability of Outage Occurrence |
| 0 | 0.98 | 0 | 0.97 |
| 100 | 0.02 | 100 | 0.03 |

**Table II—Method of Calculating System Outage Probability**

| Unit 1 Capacity Out | Unit 2 Capacity Out | | | |
|---|---|---|---|---|
| | 0 Mw 0.97 | | 100 Mw 0.03 | |
| | Probability | System Outage | Probability | System Outage |
| 0 Mw 0.98 | $0.98\times0.97$ | (0 Mw) | $0.98\times0.03$ | (100 Mw) |
| 100 Mw 0.02 | $0.02\times0.97$ | (100 Mw) | $0.02\times0.03$ | (200 Mw) |

**Table III—Summary of Final Results**

| Capacity Out ($0_k$) | Probability of Occurrence ($p_k$) | |
|---|---|---|
| 0 Mw | $0.98\times0.97$ | 0.9506 |
| 100 | $0.02\times0.97+0.98\times0.03$ | 0.0488 |
| 200 | $0.02\times0.03$ | 0.0006 |

# Integrated System Planning

These changing patterns of economic generation will influence the relative physical location of new generation and loads, emphasizing the interdependence of generation, transmission and sub-transmission facilities.

Economic considerations have required that every component of the power system be more intensively loaded. Load densities are increasing everywhere and, at the same time, larger blocks of power are being transmitted, in some cases over longer distances. These conditions, combined with changing equipment characteristics, have accentuated the problems of system design and operation.

These new factors, both economic and technical, have brought new problems, making it necessary to know more things more precisely about the whole integrated power system. Fortunately, work during the past several years has resulted in new methods of analysis, and new concepts of suitable criteria of system performance that can be developed to guide future system design and operation.

In planning future generation and transmission facilities, it is necessary that these future facilities be studied, both with respect to their costs and with respect to their reliability, from a system standpoint, in serving the load. To compare various plans realistically it is important that the alternatives provide the same system reliability or that an adjustment be made between plans to account for the difference in reliability.

### Reliability Concept Considered

The problem of evaluating system reliability has been given continued attention by the electric utility industry. Where suitable statistics are available, probability methods provide a mathematical tool to conduct such reliability investigations. These methods encompass the classical method of probability mathematics, such as the binomial expansion theorem, and such recently exploited techniques as stochastic sampling or Monte Carlo methods. But the application of these probability methods has only been made practical by the recent availability of high speed digital computers. Computers have also been applied to calculating total system costs in designing a system to provide a given reliability of service.

It is the principle of integrated system planning discussed here that alternative facilities be economically evaluated (by calculation of present worth of total system cost) on the basis that each alternate will provide the same degree of reliability in meeting the system load.

Two steps are involved in undertaking such a study:

- Calculation of the reliability of the system.
- Evaluation, on a present worth basis, of all system costs for the various alternate plans.

Several methods have been proposed for the evaluation of system reliability. The one most widely used in the industry and which leads to the simplest method of calculation is based on loss of load probability. This method involves two major parts:

- Calculation of probability of generating capacity outages.
- Calculation of loss of load probability.

To calculate the probability of capacity outages it is first necessary to prepare a table which lists the probability of forced generator outages as a function of the magnitude of the forced outage.

To illustrate the method of building up the required table, consider two units of 100 Mw capacity, one having a forced outage rate of 2%; the other a forced outage rate of 3%. This information is presented in Table I, and applied in Table II.

Note that the probability that unit 1 has 0 Mw out of service at the same time that unit 2 has 0 Mw out of service, is given by the product of 0.98 x 0.97. This of course corresponds to a system outage of 0 Mw. The probability that unit 1 has 100 Mw out at the same time that unit 2 has 0 Mw out is the product of 0.02 x 0.97, and in this case the total system outage is 100 Mw. In

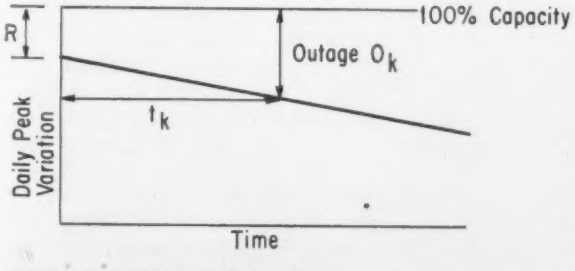



**FIG 1—DAILY VARIATION** of peak with time. Term R corresponds to reserve. For outage $O_k$ which has probability $p_k$ there will be enough capacity to meet load for time $t_k$, in days per year

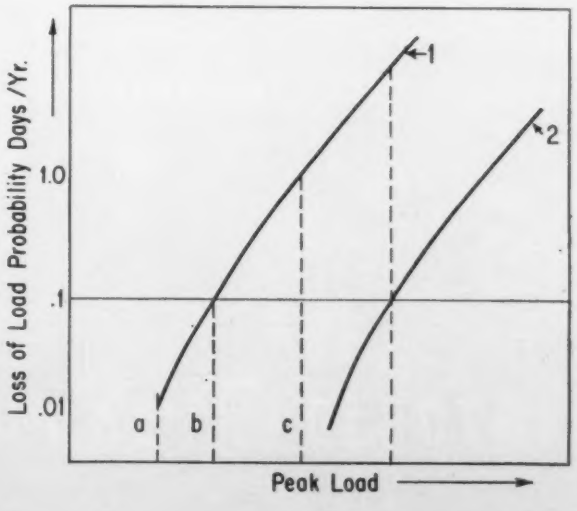



**FIG 2—LOSS OF LOAD PROBABILITY,** days/yr vs peak ▶

Table II system outage figures, in Mw, are in parentheses.

Final results are given in Table III. It should be observed that a system outage of 100 Mw can occur in two different ways so that the total probability of a system outage of this amount is the sum of two products. In later discussion the various values of capacity outage will be designated as $O_k$, and the corresponding probability as $p_k$.

The method of obtaining the required table for the system formed by these two units is given in Table II.

As a check note that the sum of the probabilities is unity, thus indicating that all possible happenings have been accounted for.

Forced outages are of concern only when they are of such value that insufficient capacity remains to meet the system load. Consequently, the next step must involve combining the probability of occurrence of the load with the previously described probability of occurrence of forced outages. Fig. 1 indicates the daily peak-load variation as a function of time. For outages less than the value R indicated in Fig. 1, there is always sufficient capacity to meet the load. For an outage $O_k$ which has the probability of occurrence $p_k$, there will not be sufficient capacity to meet the load for time $t_k$ in days per year.

The probability of loss of load, expressed in days per year, due to this particular $O_k$ is then equal to the product of the probability of outage $O_k$ occurring and the number of days per year when an outage $O_k$ will cause a loss of load. Considering all possible values of $O_k$, the total loss of load probability is then given by the sum of all the $p_k t_k$ products corresponding to the various values of $O_k$.

In actually performing calculations of this type, the effect of planned maintenance may be considered by increasing the load an amount corresponding to the planned maintenance outage. The analysis should also include the effect of load-forecasting errors intraconnection outages, and interconnections. When integrated area operation provides planned means for blocking regulators, dropping voltage, and emergency load reduction these factors must be recognized in the determination and evaluation of probable capacity deficiency.

By varying the magnitude of peak load for an assumed total capacity, it is possible to obtain a curve such as curve 1 in Fig. 2 for which the loss of load probability is plotted as a function of assumed peak load. As the peak load increases, as indicated by lines a, b, and c, it will be noted that the loss of load probability increases. Assume that the maximum loss of load probability is to be 0.1 day per year. When the peak load reaches the value indicated by c, we have now exceeded the maximum loss of load probability and would proceed to add another unit to the system. Curve 2 of Fig. 2 corresponds to the loss of load probability with a new unit added to the system. The loss of load probability now drops below 0.1 day per year.

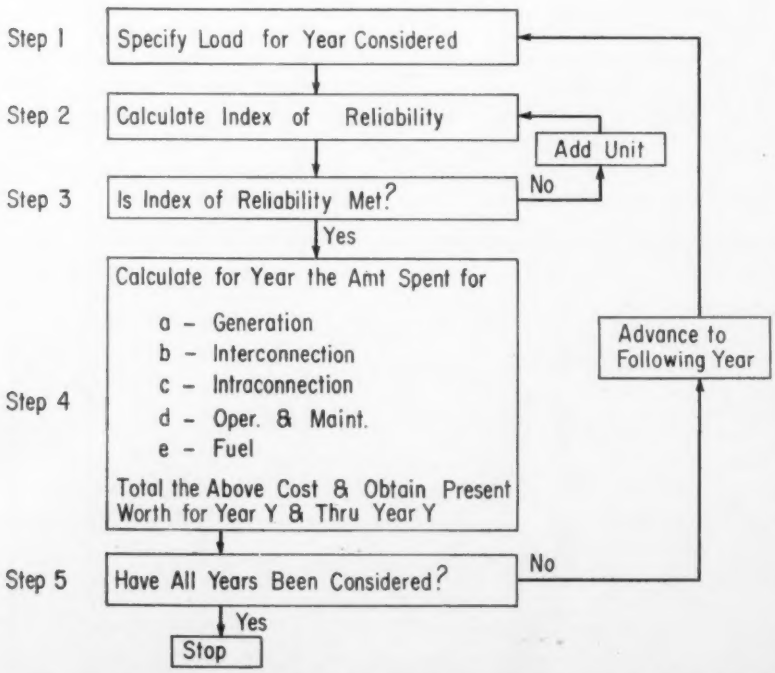



**FIG 3—SIMPLIFIED COMPUTER FLOW DIAGRAM** outlining over-all computation for comparing alternative plans of power system development

### Alternatives Evaluated

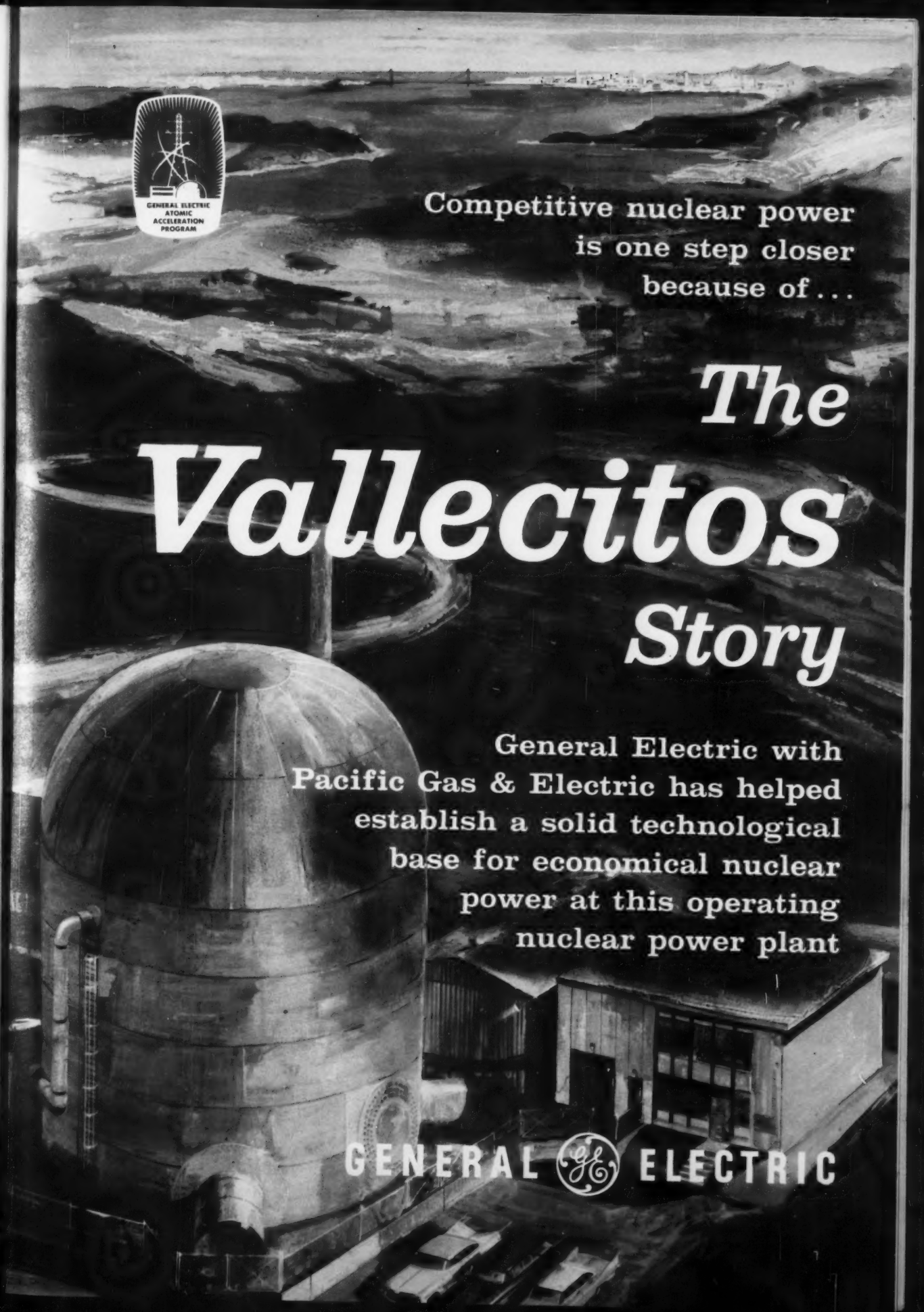
For each year of each alternative expansion, the annual costs are calculated including the following items:

General investment
Fuel consumption
Generation operation and maintenance
Transmission investment
Transmission operation and maintenance

To make an economic comparison between alternative schemes, it is necessary to refer all annual costs to the present time by considering the time worth of money. This total present worth cost may be considered as the funds provided today, which, at a given interest rate, would finance the operation of the system for the period of time under consideration.

Various high speed digital computers have been used to excellent advantage in making calculations according to the previously described methods. A simplified flow diagram outlining the over-all computation is shown in Fig. 3. In step one the load is specified for the year considered. In step 2 the index of service reliability is calculated. In step 3 the computer checks to see whether or not the generation and transmission facilities are sufficient to meet the desired service reliability. If the reliability is not satisfactory, the computer determines when additional facilities should be added. The computer then re-examines the service reliability and, if satisfactory, proceeds to step 4. In step 4 the

(*Continued on page* 59)


GENERAL ELECTRIC
ATOMIC
ACCELERATION
PROGRAM
Competitive nuclear power
is one step closer
because of . . .
The
Vallecitos
Story
General Electric with
Pacific Gas & Electric has helped
establish a solid technological
base for economical nuclear
power at this operating
nuclear power plant
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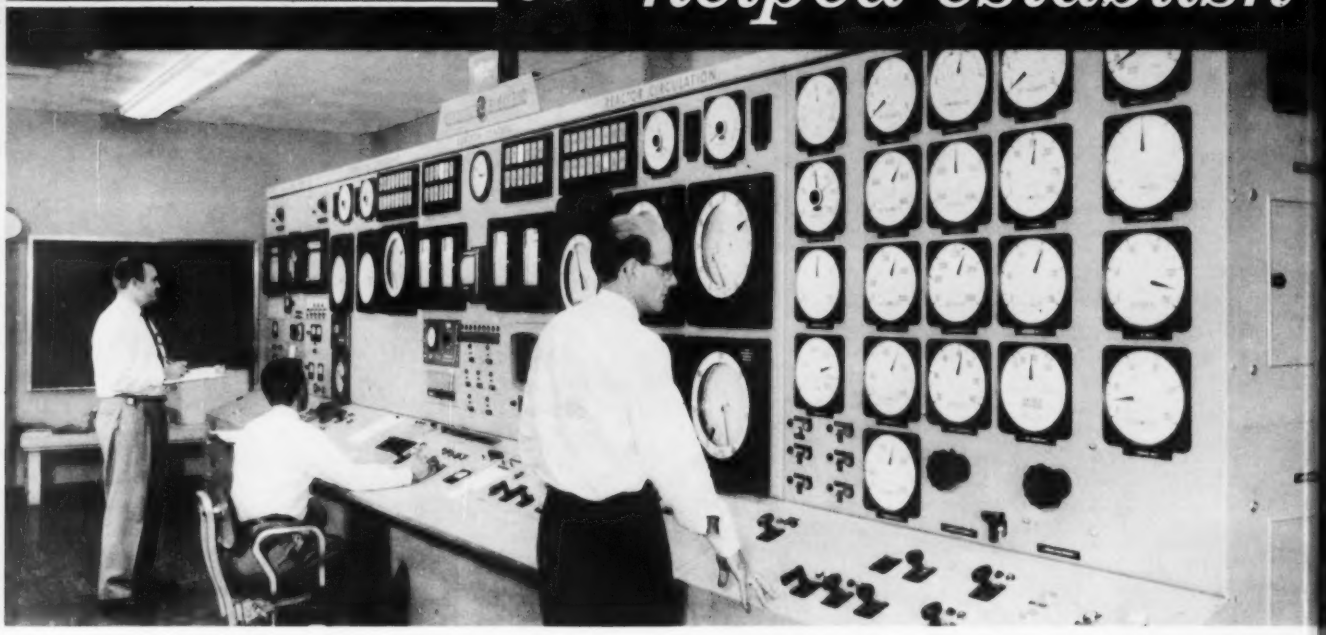
# *The Vallecitos Story:* *helped establish*



**POWER OPERATION** and experimentation provide valuable data. Operation at 900 to 1000 psi at all power outputs up to 30,000 kw(t) has been stable. Reactor responds quickly to load changes. Plant maintenance is simple; low activity levels permit direct-contact maintenance. Refueling has been accomplished in less than a day of shutdown including time required for system thermal cooling and reheat to 540 degrees F.

## Vallecitos Boiling Water Reactor experience shows the way to greater technological advances... brings competitive nuclear power closer

VBWR has performed both as a dependable power producer and as an outstanding fuel and component test facility.

These advantages of boiling water reactors for utility service have been demonstrated:

**Ease of Operation**—Start-up of VBWR from cold conditions to full-power takes only five hours. Reactor shutdown, rearrangement or replacement of fuel bundles, and restart takes only 24 hours. High-power, high-pressure operation has been stable. Refueling is fast and easily accomplished.

**Stability**—VBWR has been stable in operation at 900 to 1000 psi at all power outputs up to 30,000 kw(t).

**Rapid Response to Load Change**—Load changes from 200 to 5,000 kw in 15 seconds are performed with resultant change of only 30 psi in reactor pressure.

**Reliability of Operation**—Although primarily a research facility, VBWR has logged more than 20 million electrical kilowatt hours (over 106 million thermal kw-hr) since first operation in October 1957. Plant availability during commercial power service has been extremely high, averaging over 95% in a typical period. Unavailability resulted largely from time required to conduct experimental programs. Originally rated 20,000 kw(t), the reactor has operated at 30,000 kw(t) and is expected to operate satisfactorily at its presently licensed rating of 50,000 kw(t).

**Ease of Maintenance**—Low radioactivity levels permit direct-contact maintenance of turbine and auxiliaries using normal procedures. Radiation poses no problem to reactor maintenance.

### SIGNIFICANT TEST CONTRIBUTIONS

Extensive programs to prove oxide fuels for commercial service are in progress. Fuel elements have been tested under more severe irradiation than actual power plant operation will involve.

Plant operation experiments have included: studies of forced-circulation and dual-cycle operation; evaluation of in-core monitors and rupture detectors; determination of stability; studies of coolant chemistry, corrosion effects, and the dynamics of boiling; and evaluation of decontamination methods.

VBWR experience has added significantly to the technology of the boiling water reactor type . . . technology that is exploitable by intensive development via a clearly predictable path to economical nuclear power plants.

*Progress Is Our Most Important Product*

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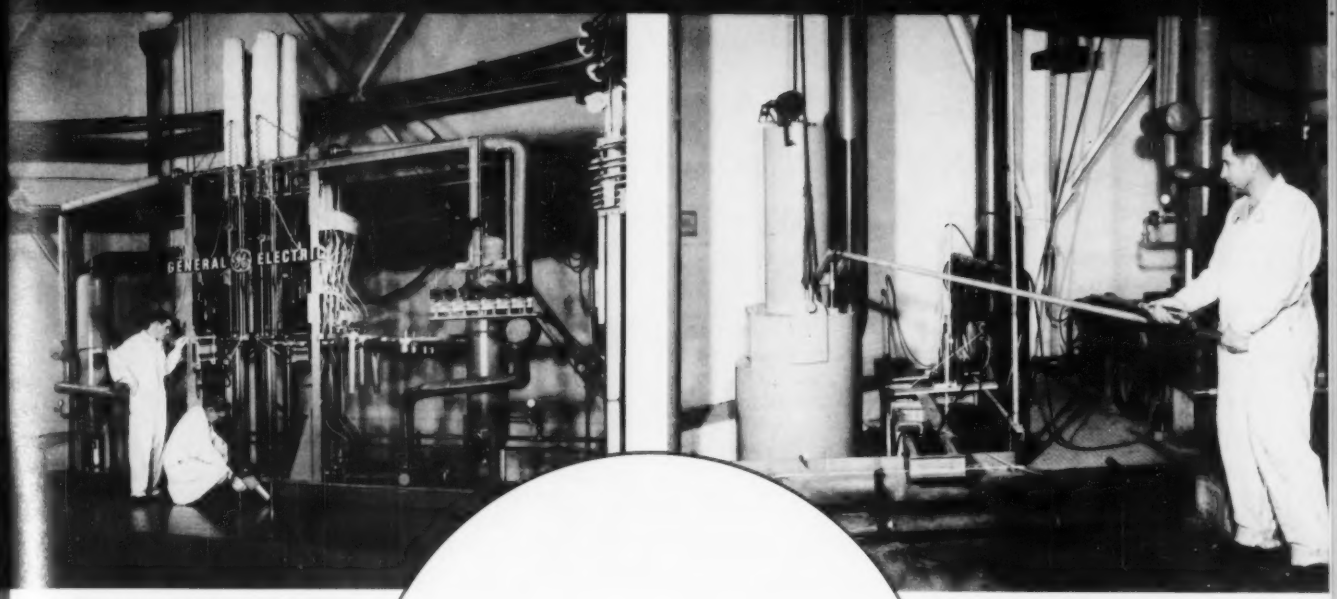
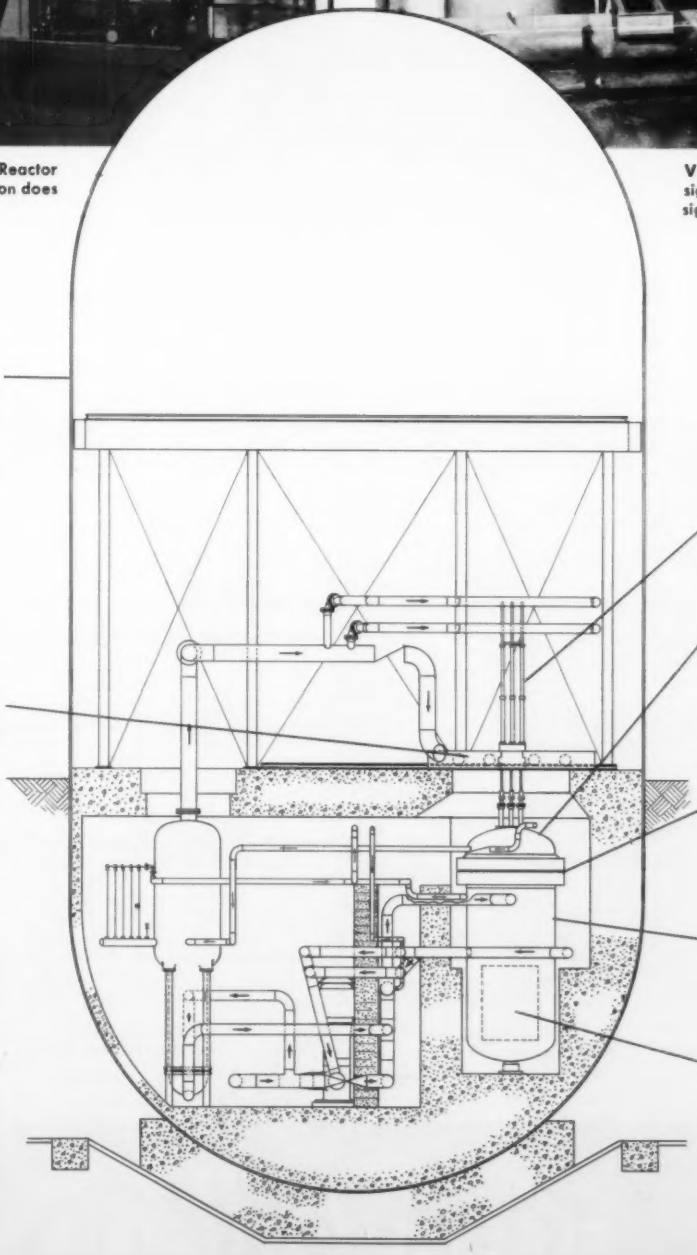
# solid technological base



**EASE OF MAINTENANCE**—Reactor maintenance is simple. Radiation does not pose any problems.

**VALUE IN RESEARCH**—VBWR design permits experiments in fuel design, rupture, long-term performance.



**REACTOR HOUSING** is 48-foot diameter, vapor-tight steel enclosure, 100 feet high. Lower area contains reactor and associated equipment including secondary steam generator for dual-cycle loop.

**BIOLOGICAL SHIELD** is 18-inch-thick steel shield weighing 80 tons. Mounted on wheels and rails, shield separates into three parts for refueling or head removal.

**REACTOR CONTROL RODS** are electropneumatically driven. Seven rods control core reactivity.

**REFUELING PORTS** are located in the top head. Four 12-inch ports allow refueling of the core without removal of the head.

**HEAD OPENING** is full diameter of the vessel so the entire core and its supports may be removed and replaced if desired.

**PRESSURE VESSEL** has 7-foot diameter, is 20 feet high, fully lined with stainless steel.

**REACTOR CORE** includes 30 developmental prototype elements of various designs being tested for power plant service.

**VBWR** is a light-water-moderated-and-cooled boiling water reactor producing 1000 psi steam which is used directly in a 5000-kw turbine.

# *after Vallecitos...acceleration*

## General Electric's Atomic Acceleration Program can broaden solid technological base, speed competitive nuclear power

Acceleration to competitive nuclear power is necessary for national security and world leadership, technological and idealogical. General Electric's Atomic Acceleration Program —a major effort in developing boiling water reactors— promises the fastest realization of that goal, at minimum cost with least technological and financial risk. The program complements government and industry objectives. Concurrently, General Electric will continue to investigate other promising reactor types.

VBWR is making important contributions in the First Generation Phase of the Program. Immediate implementation of the Developmental Phase is required, with these reactors needed to improve and test specific combinations of boiling reactor technology:

**NCB-2** The **NATURAL-CIRCULATION BOILER** reactor, rated at 50 mw(e) has been committed by P G & E for the Humboldt Bay station and will stress extreme simplification and lowered costs.

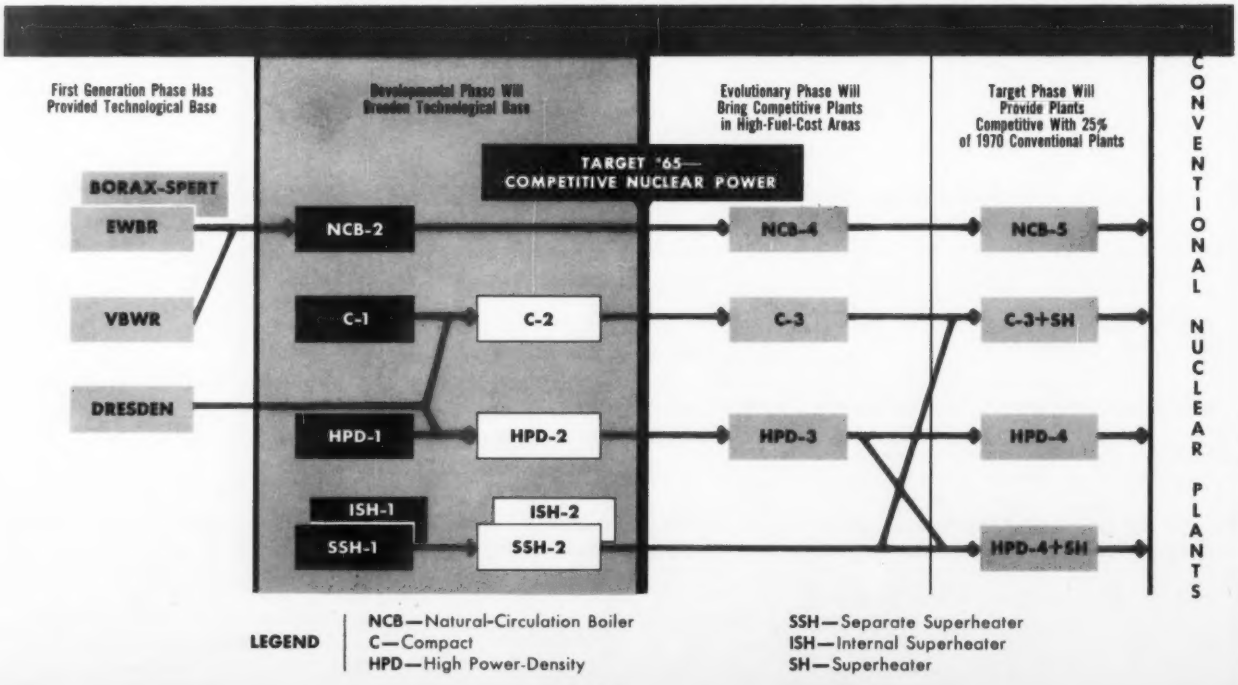
**C-1** A **COMPACT** reactor, rated at 10–25 mw(e), is required to develop optimum design and construction simplicity for forced-circulation plants.

**HPD-1** A **HIGH POWER-DENSITY** reactor, rated at 25–50 mw(e), is required to test the limits of power density and provide full-scale proving of high-power-density fuel.

**SSH-1 or ISH-1** A **SEPARATE SUPERHEATER** or **INTERNAL SUPERHEATER,** rated at 10–100 mw(e), is required to evaluate operation and maintenance characteristics, extend nuclear superheat technology.

**FOR INFORMATION** on participation in this program, contact your nearest General Electric Apparatus Sales Office or write: Atomic Power Equipment Department, 2151 South First Street, San Jose, California. Publications GED-3750, "How to Implement Nuclear Power Acceleration" and GER-1574, "Operation Sunrise," provide more detailed discussion of the program, are obtainable by writing Section 192–13, General Electric Co., Schenectady 5, N. Y.

### THE COMPLETE ACCELERATION PLAN FOR COMPETITIVE NUCLEAR POWER

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## Tools for Integrated System Planning (*Continued from page 54*)

computer evaluates, for that particular year, all of the system costs and also obtains the present worth for this year and the cumulative of previous years. In step 5 the computer asks if all years have been considered and, if not, the computer advances the load data to the corresponding to the following year. When all years have been considered, the computer has completed its work and stops.

### Generalized Studies Made

Several generalized system studies have been made using the general method outlined above. While not directly applicable to any particular system generalized studies are important in establishing new methods and in determining the relative importance of the various parameters involved. They also serve as a general guide to possible future industry trends.

The methods, as well as the computer programs developed for these generalized studies, have been most helpful in undertaking studies for individual power systems.

From these generalized studies some interesting observations can be made which are applicable and important in future power system planning.

**1.** For a typical integrated system studied, the most economical pattern of system expansion was to add units of between 9 and 6.5% of the system size. When this study was originally made in 1954 it was predicted on the basis of results that individual units of between 500,000 and 600,000 kv would be installed on some power systems within 10 years. Figure 4 shows how close was this prediction.

**2.** The economic expansion pattern for two equal, interconnected areas varies from 14 to 12% (on an interconnected system base) for an initial system load of 400 Mw, to approximately 12 to 10% for an initial system load of 3,200 Mw.

**3.** Integration of two equal areas by means of adequate transmission facilities results in approximately a 15% decrease in the cost of expansion.

**4.** The capacity of the interconnection required to integrated two equal areas to attain the assumed system reliability is slightly greater than the size of the largest turbine-generator unit.

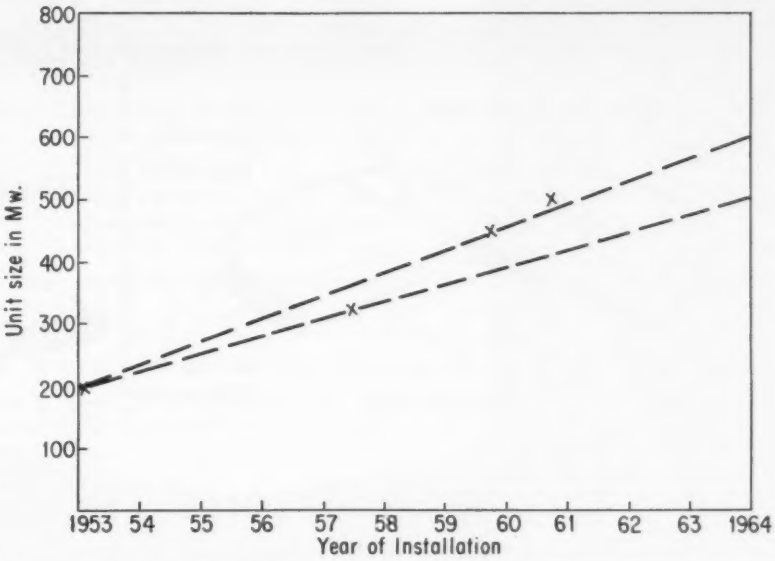



**FIG 4—PREDICTED GROWTH** in power system unit sizes. Points mark actual units now installed on power system or on order

**5.** Each 1% increase in generating unit forced outage rate requires the installation of approximately 5% more total capacity to maintain the same standard of system reliability. This provides a measure of the value of equipment reliability as the extra capacity required can be assessed as a penalty of approximately $7.50 per kilowatt against the unit for each percent increase in forced outage rate.

**6.** Detailed generating unit forced outage rate statistics have been compiled and made available to the industry. These statistics have been invaluable in making the generalized studies described above. Further refinements in over-all system probability studies will be possible only as similar forced outage data becomes available for other system components, including circuit breakers, transformers, transmission lines and cables, relaying, etc. The compilation of such data by the industry is encouraged.

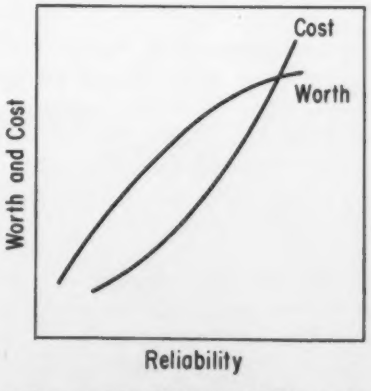



**FIG 5—COST OF RELIABILITY** can be established but corresponding worth is not well known, but presumed to have shape shown.

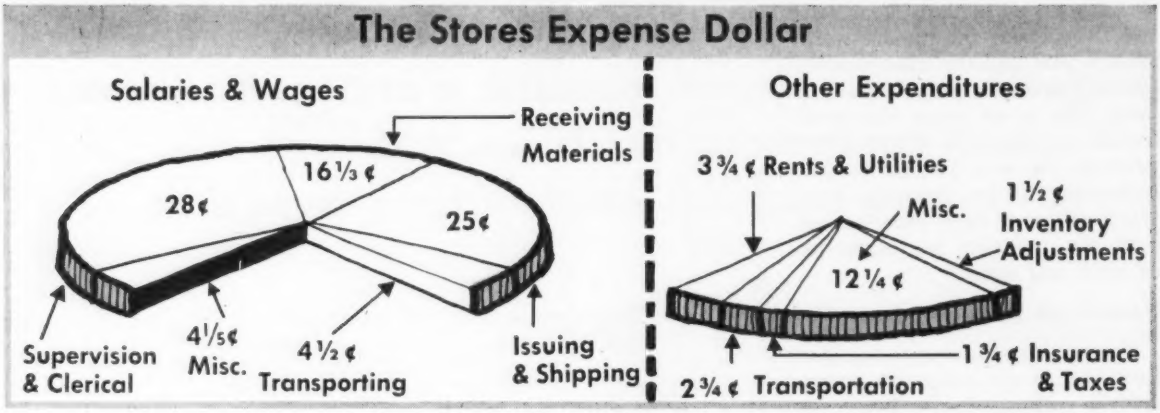
**7.** If appropriate outage data were available on such equipment as boiler feed pumps, the evaluation of unit reliability in (5) above could be used to determine the value of spares.

### Peaking Patterns Studied

In addition to studies of unit size, and the effect of intra and interconnections, the integrated system planning method has been applied to generalized studies of peaking generation, nuclear power, and future generation patterns. Based on initial work these are the conclusions:

**Peaking generation:** On most power systems the installation of low-cost generation specifically designed for short-time peak load operation can result in attractive savings. The economics of this

(*Continued on page 85*)




# Ways to Check Material Handling Expenses

*This is the second in a three-part report on the recent Edison Electric Institute Purchasing and Stores Committee meeting held in St. Petersburg, Fla. Part three will be carried next week.*

**A sizeable share of your stores dollar goes to materials handling.** The charts above tell the story. Based on the experience of seven utilities, they show the distribution of the stores expense dollar. From the charts we see that 46¢ of every stores dollar goes for materials handling—receiving, issuing, shipping, and transporting.

M. A. EDWARDS

**Are you getting full value for those 46¢?** Half the utilities queried by an EEI Purchasing & Stores project group plainly don't know. They haven't bothered to check. But from the utilities which are keeping tabs, here's some guidance reported by M. A. Edwards, Duke Power Co, who headed the Purchasing & Stores project group.

**First you need records to check performance.** These may include records on the value of material handled per man-hour between various storerooms; detailed trip reports compiled by drivers showing mileage, tonnage hauled both ways, loading and unloading time, total driving time; or records on man-hours allocated to issues and receipts putting away stock, housekeeping, etc.

**Then you need comparisons.** For instance, you may compare the stores expense costs of operating divisions, and the overall stores expense cost per dollar of issue with other utilities. Or you may compare storerooms based on average monthly stores expense per 100 customers. Or, as one utility does, you may compare costs between storerooms based on payroll, number and value of items handled, cost per customer, relationship of stores handling costs to non-stores personnel handling costs.

But whether you find it feasible or not to keep close evaluation records on your stores expenses, there are still plenty of ways of getting more value for your materials handling pennies.

**These cost-cutting suggestions for material handling** were offered by Edwards from his own experience at Duke Power:

• Phase out ordering by sub-storerooms so that you avoid costly peaks at the

(*Continued on page* 62)

# QUALITY

CADWELD ground rod and cable to steel electrical connections are superior to all mechanical or soldered types.

Competitively priced, these quality connections are permanent and cannot loosen or corrode.

Simplified ordering—specify type connection and quantity only—equipment furnished automatically.

*originators and developers of the copper thermit principle*

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beginning of each month.

- Use fork lift trucks with adjustable forks—thus making it possible for one man to handle a big share of palletized materials and conductor reels.
- Have vendor stencil company identification numbers on boxes, cartons, and reels so that they may be unloaded at storage areas without rehandling.
- Use simple locator system so that a new materials handler may become productive almost immediately.
- Keep close tabs to make sure manufacturers don't ship unassembled products and invoice them as assembled products.

## Salvage or Disposal?—A Decision that Means Profit

**What to salvage? What to throw away? There's profit to be made** in the right decision. But too much paperwork can knock the profits out of a salvage and reclamation operation. That was one of the main points made by G. A. Spencer, Detroit Edison Co, in reporting on "Store Returns—Salvage—Disposal." His advice: Use as little paperwork as possible in moving items of low value through the various departments, but paper should accompany items of high relative value subject to theft.

G. A. SPENCER

**What to salvage?** After describing the varying responsibilities for salvage in several utilities Spencer said that no matter who makes the decision it is usually made on the basis of: (1) Can we use the item; (2) when can we use it; (3) how much will it cost to hold it; (4) what is the salvage value to scrap as is; and (5) how much will it cost to repair?

**To make a salvage decision,** advised Spencer, use: (1) Records of stock balances, usage figures and salvage production; (2) knowledge and experience in costs to repair; (3) knowledge of scrap values or value as used equipment or materials; and (4) overall average costs to hold the item for possible future use or sale. A general rule of thumb applied to standard overhead line items at Detroit Edison, added Spencer, is: ". . . if the item or equipment has no definite possibility of usage or sale within three years, it will probably be scrapped. This is dependent on future possibility of removals, cost of repair, scrap value, and storage space available.

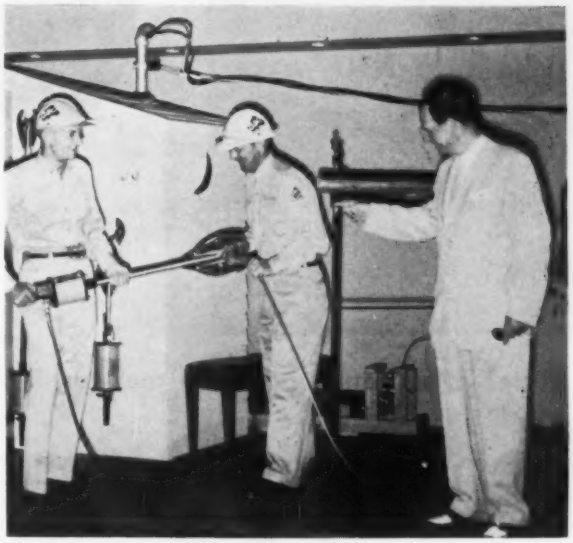
**Accurate cost evaluation is essential to decisions** on whether to scrap or salvage, emphasized Spencer, ". . . each type of item must be controlled individually. In other words, we must know the handling cost, labor cost, parts cost, etc, on each type of item." Again referring to Detroit Edison procedure, Spencer said: "In general if the labor and material cost to salvage on items is over 50% of its stock value it is probable that it should be scrapped." According to Spencer, Detroit Edison's direct costs (labor and materials) are about 25¢ per dollar on material reclaimed while labor and handling costs on scrap sold is approximately 5 to 6% of the sale price.

**Disposal of used equipment or materials should be handled by a specialist** for proper results, advised Spencer, adding that in his company this function is handled by the Salvage Sales Division of the Purchasing Department. Most sales of equipment, said Spencer, are made through used equipment dealers since purchasers tend to buy from dealers because of their wide experience with the market and the multiple dealer listings available to them.

**Utilities can get a better price** for major equipment if the Salvage Department is informed of removals as soon as possible, said Spencer. The reason for this, said the salvage expert, is that the equipment in its original position looks better and can be better inspected, tested and demonstrated.

## A. B. Chance Demonstrates New Line of Power Cutting Tools

A new line of power cutting and crimping tools was demonstrated for the first time by A. B. Chance Co at a recent utility industry conference in Washington, D. C. Shown here at the demonstration are (l to r): O. G. Anderson, product manager-tools; D. Collins; and C. H. LeVee, vp-engineering, all of Chance.



All the tools operate from any type of air compressor or standard cylinder of dry nitrogen. They are light-weight hand tools, trigger-operated, with high-speed jaws that cut or crimp in a single stroke.

The line includes: (1) a communications cable cutter for lead and plastic-sheath cable up to 3¼-in. diam; (2) guy-strand cutter for steel strand up to ½-in diam; (3) insulated wire cutter, rated 69 kv, for all-aluminum conductors of any size and copper up to 500 Mcm; (4) power pruners, available in insulated (69 kv) and non-insulated models, for cutting branches up to 2-in. diam; and (5) a crimping tool for service-entrance connections.

## New GE Transformers Carry 20% Extra Peak Load

Peak loads can be increased an additional 20% of transformer rating with no sacrifice in life expectancy for a new line of pole-type distribution transformers introduced today by General Electric. This is made possible by using a new Permalex insulation system.

The transformers, available in ratings through 167 kva, are also expected to require less maintenance than present GE designs through use of a new plastic coating that insulates the transformer covers from accidental shorting by birds and squirrels.

Other features are higher light and breaker settings for self-protected units; improved cover-mounted bushings so the internal fuse can be replaced without removing the bushing; and a rolled-under base (on ratings through 100 kva) to minimize damage from scraping.

Load increases up to 20% in the range of about 130-170% peak load are possible with no sacrifice in life as a result of the new insulation, says GE. Heart of the new insulation is a paper made from kraft pulp which has been chemically treated to retard thermal degradation—the aging and embrittlement of cellulose fibers under prolonged heating.

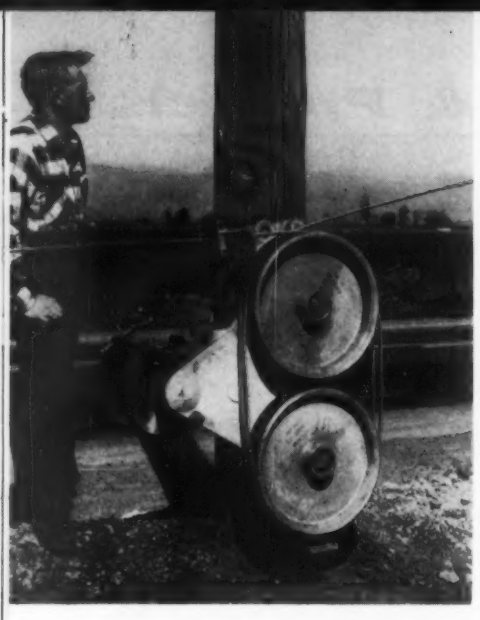
The paper is made from a kraft pulp of which the basic chemical structure has been altered in the pulp stage by a process known as cyanoethylation. This replaces some OH groups in the cellulose structure with cyanoethyl groups, thus raising the paper's thermal endurance and retarding water formation.

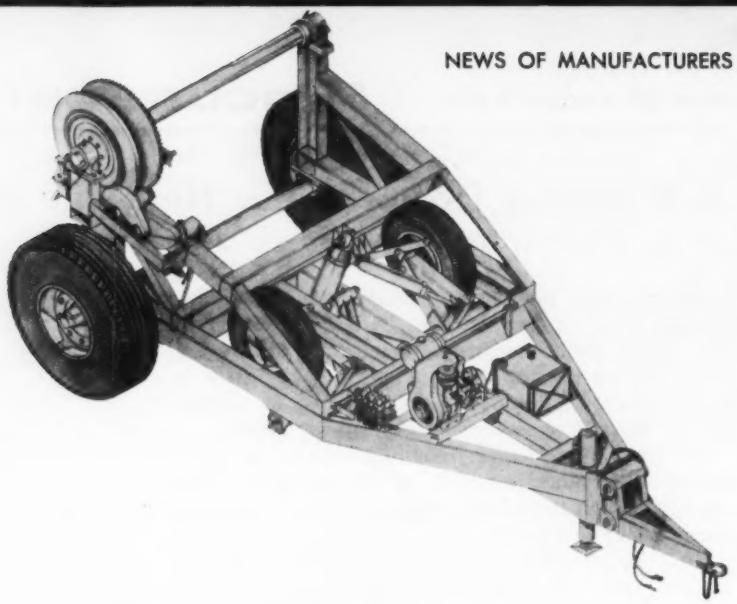
In sealed-system tests at 150 C, Permalex treated kraft paper prolonged dielectric strength retention and retained almost 80% of its original tensile strength after 3,500 hr. Other untreated materials, according to GE, weakened to 30% or less after the same period.

### *MANUFACTURERS BRIEFS*

**Westinghouse** Educational Foundation has budgeted $1,625,500 in 1959 for college and university educational programs, including scholarships and fellowships, laboratory equipment and improvement. Most of the 164 students and graduates benefiting will be enrolled in engineering and science courses. Special lab equipment valued at over $530,000 will be donated to 150 electrical engineering departments in colleges and universities. About one third of the foundation funds will be donated to liberal arts and business administration curricula . . . Partial production will start about Aug. 1 in **Anchor Metal's** new plant in Anniston, Ala. Remodeling of a 175,000-sq-ft building for manufacture of steel towers and switchyard structures will begin June 1st. Anchor's sales have increased about 800% in less than 5 years . . . **Triangle Conduit & Cable** is establishing a Bituminized-Fiber & Plastic Pipe Div. A new 114,000-sq-ft plant has

(*More Manufacturers Briefs, p* 66)





**Portable tensioner, powered reel carrier are latest developments as . . .**

# Pengo Sets Pace in Tension Stringing

A portable bullwheel tensioner for distribution work, just introduced by Petersen Engineering Co, (EW, May 4, p 82) is the smallest tensioning equipment built by the Santa Clara, Calif., company. Almost simultaneously, at the size spectrum's other end, Pengo announced a powered reel carrier of monstrous dimensions, yet devised for transport between jobs within highway limits (EW, May 11, p 62).

The portable tensioner and powered reel carrier are natural expansions of the Pengo tension-stringing line. One may spread tension stringing to many distribution jobs until now deemed uneconomical for this technique. The other rounds out the line of equipment for stringing the biggest expanded conductor (up to 2 in.) used on today's EHV lines.

The other major Pengo line, earth-boring augers, is as subject to size increase, efficiency improvement, and application enlargement. Augers to 96-in. diam are available, research toward optimum positioning of cutting teeth continues, and auger teeth are being tried successfully as trenching tools.

Pengo now has over 2,500 customers in 15 countries. The company believes these customers have grown to expect and appreciate its advice and suggestions on routine as well as unusual applications of its equipment. From these contacts stems the two-way communication which provides the latest product ideas, and starts the chain of research and development which underlies Pengo operations. Possibly this is why the company has no serious American competitors in tension stringing.

At the war's outset, Gerald Petersen, now Pengo president, entered the overhead line construction business. He devised for his own use many types of equipment to fill the need for new approaches to line construction, thus formulating the principles behind Pengo tension stringing. Later, to capitalize on development of a unique earthboring auger, he formed Petersen Engineering.

The first Pengo tensioner satisfied the demand for pulling equipment that kept cable off the ground. It featured bull wheels with perhaps Pengo's greatest single contribution, neoprene-lined grooves. The grooves gripped the conductor and held it under tension as high as 25,000 lb without damage. Under control of mechanical brakes, the cable comes off the bullwheels and onto the line under tension at speeds to 4 mph.

Pengo then provided the next item—the power-driven bullwheel cable puller, which powers the pulling line over bullwheels, paying it to adjacent reels under reduced tension.

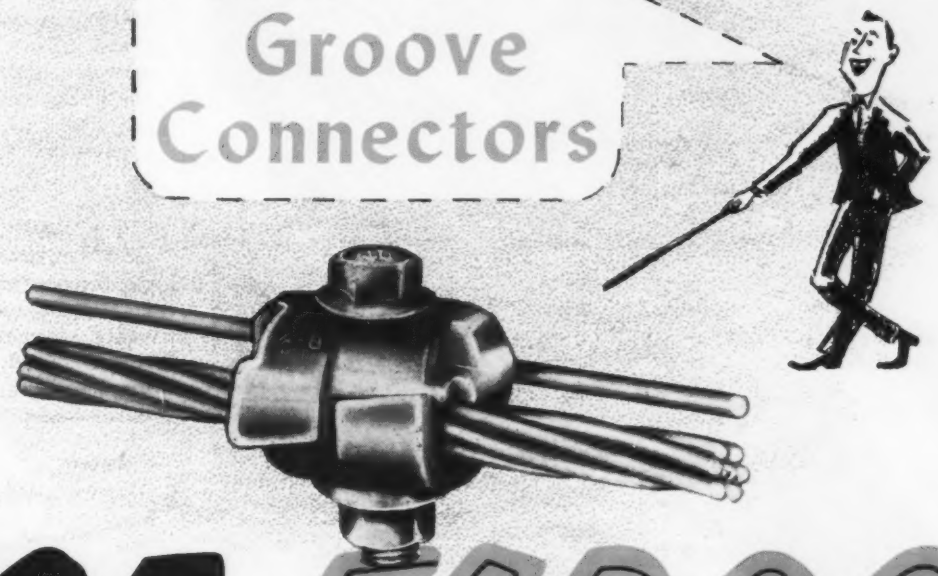
The take-up reels still needed rotating, so Pengo built a powered reel winder. This now has a torque converter to ensure constant light tension for an even wrap of the pulling line or possibly salvageable conductors.

Expanding the line size-wise, Petersen moved both ways. Pengo equipment can handle the largest commercial jobs; and when utilities began to eye tension stringing for distribution, particularly urban reconductoring, smaller more economical rigs were devised.

Pengo doesn't confine research and development to areas of immediate results. For instance, its heavier equipment designs are undergoing tentative modification against the time, felt not far off, when much mountainous transmission will be built without access roads, with all material and equipment transported by helicopter.

An even longer-range example is Pengo's probing into future designs for underground cable construction equipment. Here the company sees the day when much overhead transmission and distribution will be forced underground.

# if you use Parallel Groove Connectors



# USE FARGO

## Because . . .

1. interlocking finger design gives complete conductor encirclement and perfect alignment.

2. extra long contact areas assure good inter-strand connections and minimum "creep" . . . mass provides ample heat dissipation.

3. high strength heat treated castings and bolts eliminate breakage. Castings and washer are aluminum and bolts and nuts are steel with a heavy hot dip galvanize.

4. built in spring action maintains contact pressure under changing loads.

5. clamps are clearly marked and factory dipped in Fargolene, a corrosion inhibitor, which maintains clean contact surfaces.

6. a wide range of conductor sizes can be accommodated in each connector for aluminum to aluminum or aluminum to copper connections.

Ask your Line Material Field Engineer for complete details.

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are applied to cables
for underground use
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Amp-trap®
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***Amp-trap,*** SHAWMUT's famous current limiter, provides the most effective protection against short-circuit yet achieved. Because it functions far faster than any mechanical device, it interrupts short-circuit currents long before they can build up to dangerous values. Complete interruption of short-circuit currents occurs in a few milliseconds.

Amp-trap® SAVES CIRCUITS

More and more utilities and industrial systems use ***Amp-trap*** Cable Protectors (CP-6) to cope with short-circuit currents of ever increasing magnitude. Use CP-6s in secondary and spot networks, for bus ties, cables above and below ground — particularly on the new higher voltage systems such as 265/460 volts. You can use them wherever large blocks of power are present, where available fault currents are high and where installations have become inadequate due to growth. Ask for Bulletin CP-6.

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## Manufacturers Briefs

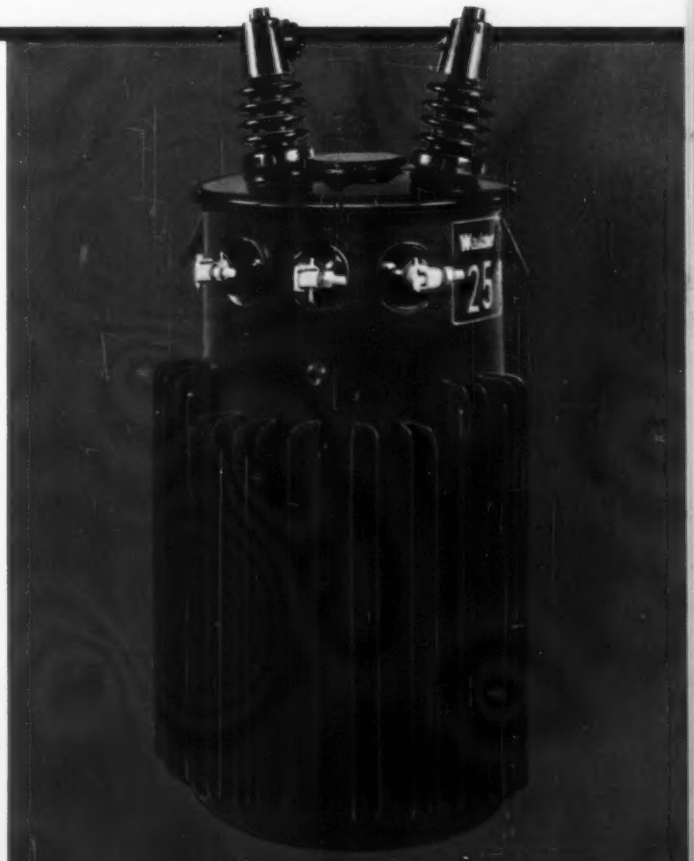
(*Continued from page* 63)

been purchased in Landisville, N. J., to which plastic pipe operations will be shifted and where manufacture of bituminized-fiber products will begin at year's end . . . **Scovill Mfg** extends its tube line to include copper tube and pipe for air conditioning and heating applications. A $10-million tube mill recently completed in New Milford, Conn., permits production of longer lengths of the company's heat exchanger tube line . . . **Federal Pacific** will market, under its own trade name, all products of its wholly owned subsidiary, Roller Smith. As part of the reorganization, R-S will continue manufacturing operations under the new name of Fifty Avenue L, Inc. Indicating instruments and rotary switches will be made in a new 84,000-sq-ft plant in Newark; special-application oil circuit breakers at Scranton, Pa. . . . **General Electric** starts tower erection on Project EHV this month, also construction of a substation and administration building. A committee of 12 consulting engineers, at GE's invitation, held their first review and planning meeting May 27 in Pittsfield, Mass., on the 5-year project which will eventually carry 750 kv . . . **Babcock & Wilcox** recently shipped, for **Westinghouse,** the 70,000-lb reactor pressure vessel for Belgium's first nuclear power plant. Shipment to the 11,500-kw power station was made under first U. S. export license issued for an atomic power plant . . . **Kuhlman Electric** now furnishes, upon request, distribution transformers coated with "Perma-Gold" paint to match the gold plaques displayed on all-electric Medallion homes . . . Observance of the 5th anniversary of **General Electric's** Medium Transformer Dept at Rome, Ga., was marked by production of the 12,000th unit, a 5000-kva load-tap-changing transformer. In addition to medium transformers, the department now manufactures liquid-filled distribution transformers, 112½ to 500 kva, 15 kv and below; sealed and open dry-type transformers, 300 kva and above, 15 kv and below; integral distribution centers; and transformers for load center unit substations and master unit station.

The distinctive blue and gold Wagner identification on pole-type transformers is a sign that here is a transformer you can rely on for utmost dependability. Constant research and development have kept Wagner up front in transformer design for more than 65 years—made the name Wagner one of the foremost in power planning.

## LONGER LIFE... GREATER EFFICIENCY... DESIGNED FOR MODERN-DAY LOADS

# Wagner FORM W Transformers

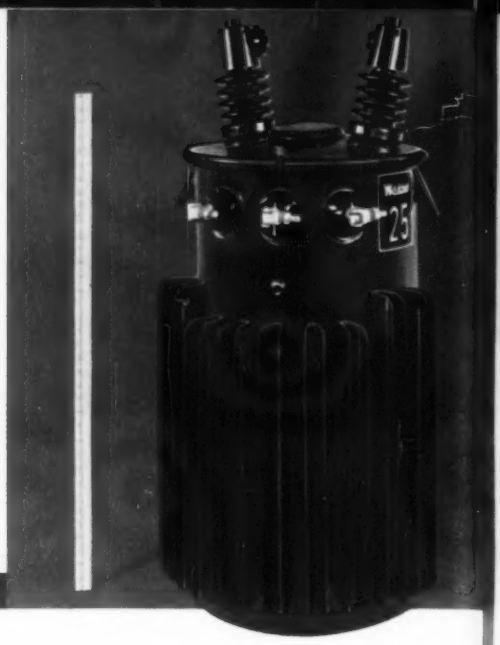


Wagner Form W single phase pole-type distribution transformers have been designed for lower impedance values, better regulation and lower losses. They have mechanical features that give you easier installation, safer operation, and longer service life.

GUARANTEED LOSSES REDUCED... Wagner's published electrical performance sheets for a 25 kva, 7200 volt transformer show that guaranteed core losses have been cut approximately 12 per cent . . . total losses cut approximately 5 per cent. Other kva and voltage ratings have correspondingly improved loss ratios.

The complete line of pole-type transformers, from 3 to 167 kva, is available from stock to meet your distribution system requirements.

# Here are the *Extra Values* that you get with Wagner Form W Transformers

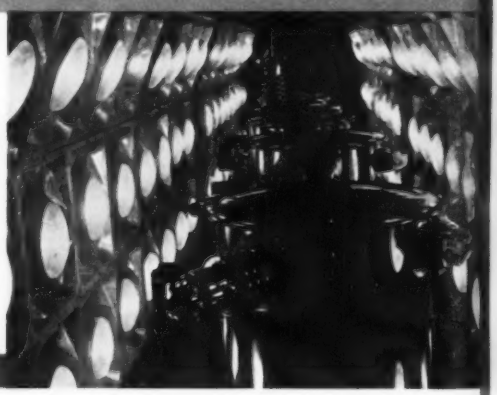


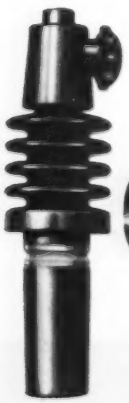
### SMALLER SIZE THAN EVER BEFORE

Wagner's line of single phase pole-type distribution transformers has been redesigned to give you extra value from your transformer investment. One result of this redesign is a substantial reduction in size. The 25 kva Type HEK Transformer, for example, is now only 41⅝ inches high — including the cover mounted bushings!

**LOWER EXCITING CURRENT**. . . the improved quality annealed steel core used in these transformers provides a low reluctance path for the magnetic lines of force resulting in a much lower exciting current. Lower impedance, better ratio of losses, and improved regulation have also been achieved.

**LONGER LASTING TANK FINISH**. . . A new formula anti-corrosive paint is hot spray applied on tank sizes below 50 kva—flow coated on larger sizes. A primer coat, intermediate coat and finish coat are each cured by running the tanks through a tunnel of infra-red lamps or through controlled heat chambers. The result is a "Sure Seal" finish that withstands all temperature changes — is much longer lasting in corrosive atmospheres.





### SAFETY-KEYED BUSHINGS

Heavy wet process porcelain high voltage bushings are safety-keyed. All terminals are key-locked in the bushing porcelain — sidewall bushings are key-locked in the tank wall. Hand tightening terminals are easily hooked up without tools. Cover bushings have insulated terminal guards to prevent outages caused by birds or animals. All bushings are suitable for use with either aluminum or copper conductor.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

**Wagner Electric Corporation**

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WT59-8

SERVING 2 GREAT GROWTH INDUSTRIES . . . *ELECTRICAL* . . . *AUTOMOTIVE*

Report on
**Rates and Regulation**

# Which Way with Section 167?

**Liberalized depreciation is five years old.** But the question of what the utilities should do about it seems no closer to a pat answer than it did in 1954 when Congress passed Section 167 of the Internal Revenue Code—allowing business to write off more of its plant in the early years of life through the sum-of-the-years-digits or declining balance method. Today advocates of the various ways of treating liberalized depreciation cannot even be aligned into clearly-defined camps. Informed opinion boxes the compass—from full normalization to "flow through," from compromise to out-and-out repeal of Section 167.

The wide range of opinion was nowhere demonstrated more clearly than at the National Conference of Electric and Gas Utility Accountants held recently in Chicago. Speakers from within the industry and from without gave opinions, predictions and cold, hard facts that wrapped up the subject of liberalized depreciation as neatly as such an ungainly package could be wrapped. Two conclusions stood out:

- **After five years, there are still new approaches** to splitting the benefits of liberalized depreciation between utility and ratepayer. Cortis N. Rice, Jr, of Northern States Power Co prepared a paper on one new compromise plan.

- **There is a strong current of feeling that normalization is a lost cause.** Recent acts of the state commissions have left an impression that—regardless of the apparent intent of Congress—the choices left open to utilities now boil down to either giving the benefits of liberalized depreciation to present ratepayers or else passing them up altogether.

**Basic framework for the conference was a factual economic study** of five schemes for handling liberalized depreciation presented by Malcolm G. Davis of Gilbert Associates, Inc. The Gilbert Study (EW, Feb 10, 1958, p 97) contrasted the capital costs and revenue levels that would be likely to follow a utility's adoption of each method. Eight other speakers gave their views on specific aspects of liberalized depreciation or added facts to the framework.

**The keynote speaker drew a bead on the whole concept of Section 167.** Professor William A. Paton of the University of Michigan lost no time in stating that he favored the same rate of depreciation for book and tax purposes, and a higher one for both. "It's a shame that this charge came to be called 'depreciation' in the first place," he said. "It would be better if it were called 'Esti-

mated Plant Capacity Consumed.'" Paton decried the way depreciation was thought of as being different from other costs of running a business, and not an 'out-of-pocket' cost. "Actually," he said, "it is an out-of-pocket cost *par excellence*. You have to build plant before you can produce gas or electricity." Taking issue with the term "cash generated by depreciation," Paton was emphatic: "It's not so," he said. "Recognizing depreciation doesn't provide any funds whatever. If you don't deduct for it, you overstate income."

"Because of the enormous risk of installing plant," he went on, "more of it should be depreciated early. I'm sorry we didn't take liberalized depreciation for both taxes and the books." Smiling at John Childs, vice president in charge of the utility department at Irving Trust Co, who was to follow him on the program, Paton added: "Of course then analysts would have said: 'We can't sell your securities. We need those faked earnings.'"

## Facts from the Analysts

**Childs reported how security analysts felt about "those faked earnings."** In 1957 and again this year Irving Trust Co asked 15 analysts how they would handle the different methods of taking liberalized depreciation when analyzing securities. Childs emphasized that his report was not based on what these analysts thought should be done by utilities, but was simply a factual account of how the analysts would give credit under each method of treatment.

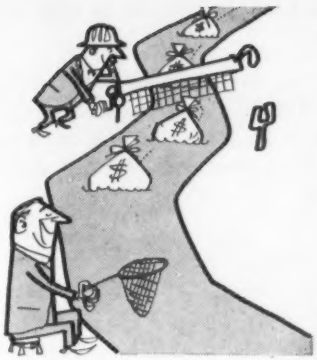
**The survey's conclusion: "You get more credit if you let it flow through** to earnings." More analysts said they would credit liberalized depreciation savings if the utility used "flow through" in 1959 than in 1957. And less said that they would give credit for normalized savings. In computing capitalization ratio, 12 out of the 15 would include "flow-through" savings as equity capital. With normalization, however, only five analysts would give credit if the saving were put into restricted surplus, and less if it were put into a reserve.

In calculating P/E ratios, the analysts were even less enthusiastic. Nine said they would include the tax saving in earnings if it were flowed through; four said they would exclude it even then. When normalization is used, four would include it if placed in a special reserve for deferred taxes or labeled as accumulated deferred taxes on income, three if it were put into restricted surplus, two if it were put in depreciation reserve.

**Many analysts stressed, however, that their opinions could change** if regulatory developments warranted, and several made the point that they favored normalization in principle, regardless of how they treated normalized tax savings for analytical purposes. Said one: "Where the commission has not ruled, the treatment would vary with the objective. To be conservative, one should assume the worst. To be realistic, perhaps one should assume the best."

## The Case for 'Flow Through'

**Why take liberalized depreciation at all if the company must "flow through"** all tax savings to the rate payer? The answer was presented by John B. Madigan of The Hartford Electric Light Co. "Management has an obligation," he said, "to keep all operating costs as low as possible. Certainly this obligation should extend to the area of one of our largest items of expense, namely taxes." Noting that his company had cut its tax bill by 14% in 1957 and 30% in 1958 by using liberalized depreciation, Madigan asked: "If it were possible to effect a saving as large as this in any of the other categories of expense, would we hesitate to do so? . . . If a regulatory commission treats us fairly in most respects, as ours happens to do, we cannot object if they believe that these tax reductions should be used for the benefit of the customer."



**Normalization, said Madigan, "is most inequitable,** for it is requiring present ratepayers to subsidize other ratepayers of the far-distant future." He cited studies showing that cumulative tax savings will still be growing at the turn of the next century, and noted that they would continue to grow as long as the industry kept growing—or as long as there is any inflation.

The intent of Congress, Madigan asserted, was to encourage industry to modernize machinery and equipment. "In our industry, however," he continued, "to be realistic, accelerated depreciation does not stimulate to any great extent the replacement of obsolete equipment. Does anyone seriously contend that our plant would not have been expanded as fully or as rapidly, or that our maintenance program involving replacements of units of property would have been curtailed if it were not for accelerated depreciation? Perhaps it achieved all these things for other taxpayers, but certainly not for us. What was achieved was, in effect, nothing more than a reduction in taxes equivalent to the lowering of the present corporate rate of 52%; and, if income taxes had actually been reduced in such manner, would anyone argue that we ought to be allowed to retain the savings over and above the fair and normal rate of return?

**"When these tax savings are passed back to the customer,** however, the flow-through company does not suffer a complete economic loss. Rather it gains a competitive economic advantage, at least in certain areas such as in gas and oil heating versus electric heating."

## Dividing the Benefits

**Representing the "compromise" approach to liberalized depreciation benefits,** Cortis N. Rice, Jr, of Northern States Power Co had two contributions. First, he analyzed the "Wisconsin Method," where actual taxes are charged to tax expense, and an amount equal to the tax saving goes into the depreciation reserve and is excluded from the rate base. He noted that the "Wisconsin Method" had the advantage of dividing the benefits between the customer and the company, and also that it is an effective way to build up a depreciation reserve. But, he added, "when the reserve becomes significantly greater than needed, then the annual depreciation rates used in the corporate accounts may be reduced to the point where the method becomes equivalent to . . . flow-through."

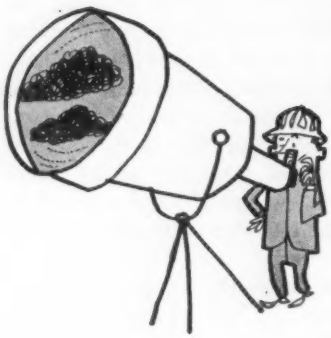
**Rice's second contribution was a new plan** for treatment of liberalized depreciation. This plan also gives benefit to both company and customer. Under "flow-through," Rice pointed out, it is possible to reduce rates so that the customer actually would obtain twice the tax reduction and the company would still have the same net return as before. This is because taxes are cut not only by the increase in depreciation expense, but also by the decrease in revenues.

"The compromise plan which I propose for consideration is to give the customers, by reduced rates, the actual amount of the decrease in taxes due to the use of fast depreciation. If this is done there will be an additional reduction in taxes equivalent to 50% of the reduction in revenue, or 50% of the reduction in taxes, and this would accrue to the company. This procedure would result in substantially reduced costs to customers and also provide a very real benefit to the taxpayer, which Congress apparently intended. It could be argued, and very strongly I think, that after a two-to-one distribution such as this, the company should be free to use the proceeds to its own benefit as it chooses."

**These proceeds could be added to the company's present rate of return,** to compensate it for the risk associated with greater consumption of its depreciable tax base. "With this plan the tax saving available to the company is no different from other earnings that belong to the company and could, of

course, be added to the depreciation reserve if needed, or it could be used for economic depreciation or other types of expense."

Rice's paper also outlined some modifications of this plan, showing how it could be made to meet different conditions. "My main purpose," he concluded, ". . . is to show that the methods which have been used do not include all of those which could be used, and that we can profitably devote some further study to the general subject of liberalized depreciation."



## The Outlook: Cloudy

**For normalization advocates, the outlook is cloudy.** That was the appraisal of George Logan, Philadelphia Electric Co, who succinctly covered legislative and regulatory trends affecting liberalized depreciation. Noting that bills are due in this session of Congress, he mentioned the possibility that "if economic depreciation gains, liberalized depreciation may be dropped" from the tax law. In regulation, Logan said: "The trend of passing on the benefits of liberalized depreciation to the customers seems to be growing on the East Coast, and has jumped to California."

**In California, "Liberalized depreciation got into politics,"** said Barnard Morse of Southern California Edison Co. Hearings there are slated to drag on to the end of the year, and the outcome is still in doubt. Latest development was the presiding commissioner's introduction of economic depreciation into the California hearings. Utilities, Morse reported, were still pondering the move.

## "The Handwriting Is on the Wall"

**"The pendulum is swinging still farther away from normalization,"** said Arthur H. Kuhn of Pioneer Service & Engineering Co. Referring to the recent policy statement of the New York Public Service Commission, he said: "The handwriting is on the wall . . . it's a 'heads I win, tails you lose' proposition—with the commission tossing the coin."

". . . The concept of liberalized depreciation was sold in the first place by the capital goods industries, which are not regulated," Kuhn continued. "They were designed to meet many problems that are not related to the utilities. Once it was passed, it became available to all companies. The utilities see a chance for free capital; the commissions see a chance to reduce taxes and pass on the benefits to the customers. With all the confusion and inability to agree on the right way to handle Section 167 . . . it may be that concerted action for repeal would serve the best purpose for everybody. Once that's accomplished, maybe another method could be found to accomplish the purpose."

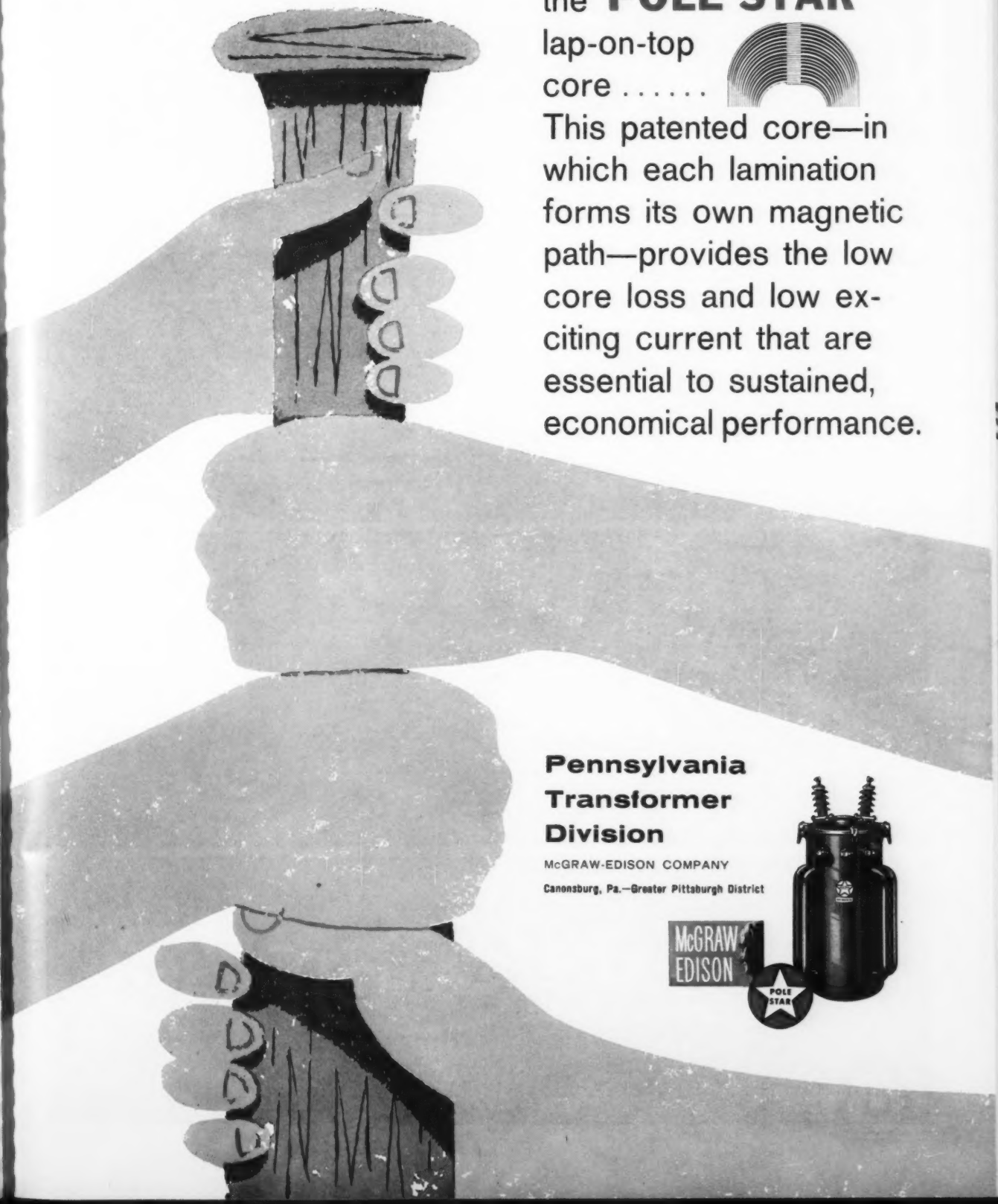
**A convincing case for abandoning Section 167 entirely** was supplied by C. N. Ostergren of American Telephone & Telegraph Co. AT&T does not use liberalized depreciation, primarily because of the complications involved for a company operating in so many jurisdictions. "The biggest problem," Ostergren said, "is that the utility industry has been galloping off in all directions instead of pulling together."

**He called for higher book depreciation rates, and for repeal of Section 167.** "It looks to me," he said, "as though all utilities stand to gain if we talk a little less about tax purposes, and more about book purposes . . . If the liberalized depreciation provisions of Section 167 were repealed," he said, "I believe it might be possible to substitute economic depreciation. At this stage of the game, I believe this could be accomplished without any decrease in tax revenues to the government."

When **"choosing up"** distribution transformers . . . .

consider the merits of the **POLE STAR** lap-on-top core . . . . . 

This patented core—in which each lamination forms its own magnetic path—provides the low core loss and low exciting current that are essential to sustained, economical performance.



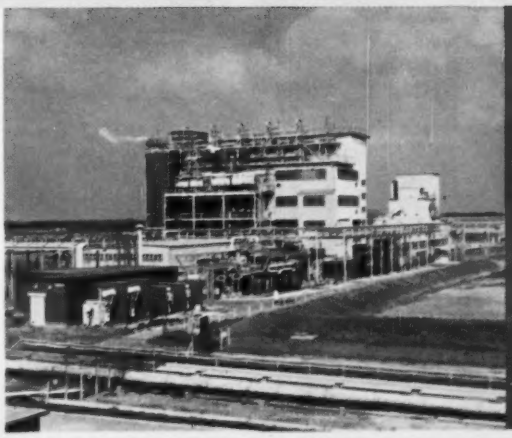
**Pennsylvania Transformer Division**

McGRAW-EDISON COMPANY

Canonsburg, Pa.—Greater Pittsburgh District

# THE MUSCLES OF TOMORROW

**Will be produced in plants Stone & Webster builds today**



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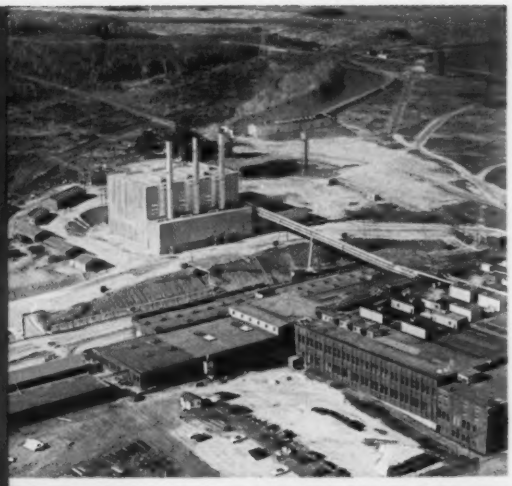
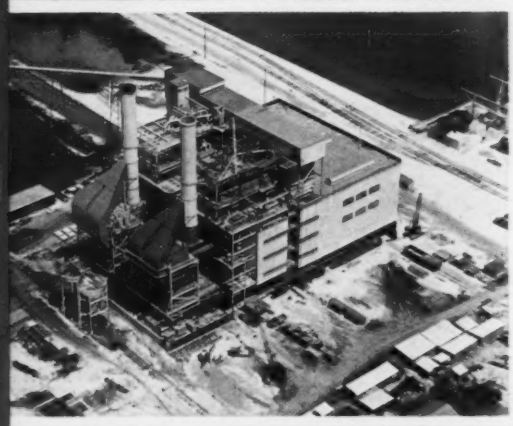
**ENGINEERING CORPORATION**
A Subsidiary of Stone & Webster, Inc.

Atomic, hydroelectric and steam power, new plastics formed by molecular chemistry, new products from molded pulp and paper . . . these are some of the materials and forces that are reshaping our universe. These very same materials and forces are being produced today in plants designed and constructed by Stone & Webster.

Building today for tomorrow's needs has been Stone & Webster's objective for 70 years. The plants we build today must compete profitably with tomorrow's plants. This can only be achieved by reducing construction and operating costs . . . by scrupulously respecting client budgets and schedules.

If your company is contemplating expansion or actively planning new facilities, let us demonstrate how Stone & Webster's experience can add to your future profits. Call or write our nearest office.





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## A secondary capacitor for *lowest* installed cost per kilovar

Sangamo Secovar 240 volt secondary capacitors are installed at the customer's service to give maximum system benefits all down the line. This new addition combines a 2 kvar capacitor with a meter socket. When used in new construction or when re-wiring, the only installation cost involved is that which would normally be required for a meter socket.

Sangamo's exclusive Secovar Capacitors are available in three types to meet your requirements: The new Type OS (Original Socket) 2 kvar rating; Type S, a 2 kvar rating for socket mounting; and Type N, a 1 or 3 kvar rating for nipple mounting. All types are fused and some models can be furnished with a Klixon thermostatic switch if desired.

For details, consult your Sangamo Representative, or write for Bulletin 1132.

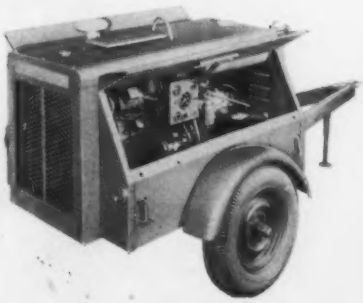
**SANGAMO ELECTRIC COMPANY**
Springfield, Illinois

PC59-3

(For further information refer to Reader Service on page 80)

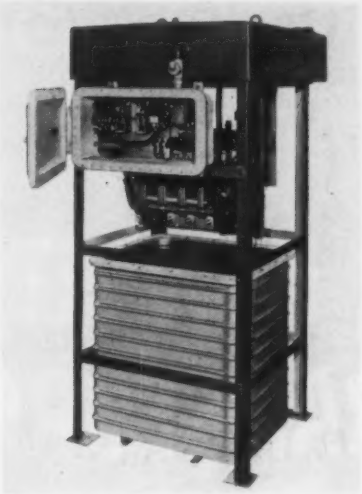
## Interrupter . . .

**. . . for metal-enclosed switchgear** is capable of interrupting loads of 600 amp without external arcing or emission of smoke. Current is shunted through the air switch-mounted Powerupter as switch opens. Arc is breached between a mechanism-activated contact and a stationary one and is quenched by gas-evolving lining of porcelain-enclosed chamber. The Powerupter is self-contained, uses no oil or gas for arc interruption and requires no maintenance during its normal life. It is also available for outdoor switches at voltages up to 34.5 KV.
**H. K. Porter Co, Inc, Delta-Star Electric Div, Chicago, Ill.**



## Air Compressor . . .

**. . . combines single-stage simplicity** with two-stage economy. Both engine and compressor of the 85-cfm Super Blue Brute reach peak efficiency at 1,800 rpm, substantially lower than other portable compressors. The single-stage unit has discharge pressure settings of from 75 to 125 psi. It is powered by a 168-hp Continental engine.
**Worthington Corp, Holyoke Div, Holyoke, Mass.**

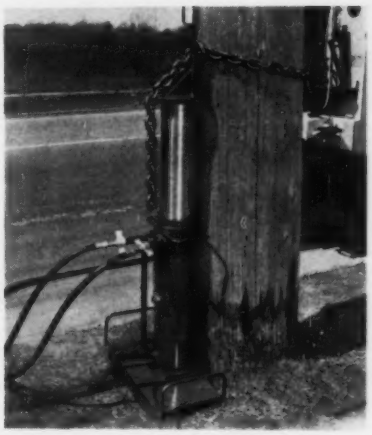


## Motor Controllers . . .

**. . . for squirrel cage motors** are available in two new classes. The NEMA Class E1 starters are oil-immersed, explosion-proof 2,000-5,000-v units designed for hazardous and semi-hazardous locations. They are rated at 50-Mva interrupting capacity and provide built-in short circuit protection to a motor on systems having a maximum of 50 Mva capacity. Starters are available in a floor-mounted lift-out type with all components immersed in oil, and in a frame-mounted tank lowering type with only high voltage components immersed in oil.
**Allis-Chalmers Mfg Co, Milwaukee 1, Wis.**

## Pole Jack . . .

**. . . speeds pole pulling** and has design features which assure a long life. One man carries the jack, sets it next to the pole and wraps a chain around the pole and through the jack. He then connects hydraulic lines from the jack to the truck body and pulls the control lever to activate the ram. The Series 4600 pole jack and its detachable base are so arranged that the jack can be tilted to allow for uneven ground.
**Holan Corp, 4100 W 150th St, Cleveland 35, Ohio.**



## Luminaire Control . . .

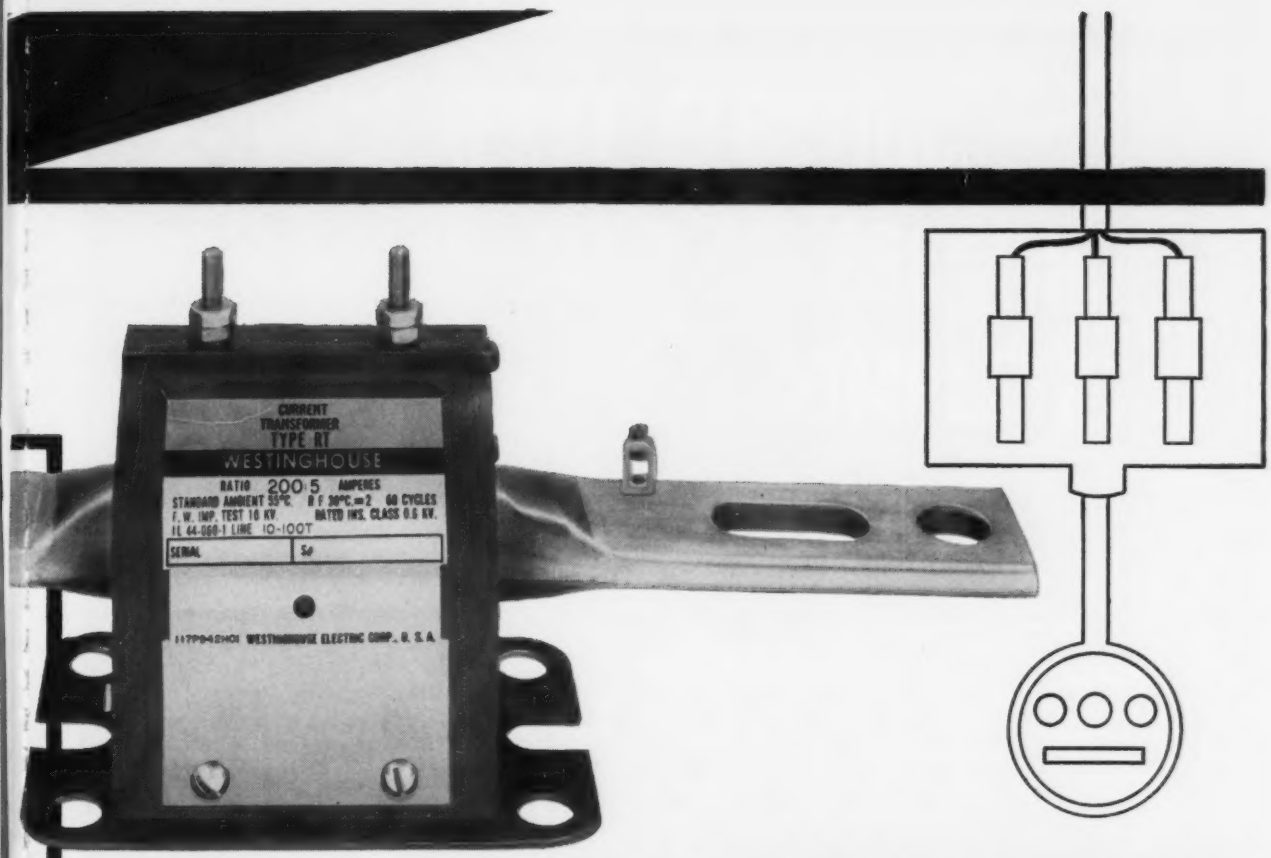
**. . . conforms to EEI-NEMA standard.** The Model 6600A control has a sponge neoprene gasket affixed to the base plate. The easily-removable gasket provides a seal between control and luminaire head.
**The Fisher-Pierce Co, S Braintree 85, Mass.**

## Circuit Breaker . . .

**. . . for low-voltage applications** offers "visible break" to determine whether a breaker is connected or disconnected. The model, designed

(*Continued on page* 80)

NEW RT
TRANSFORMER
SAVES UP TO $36 ON




# EACH INDOOR INSTALLATION!

Why pay for outdoor protection for an indoor installation when you can save over one-third with the new Westinghouse L-V current transformers designed for "indoor" use only! If you've been paying premium prices for outdoor-type, low-voltage current transformers and then mounting them indoors, or outdoors in a weatherproof box, here's important news. Our new RT transformers are specifically designed for installations where the more expensive molded weatherproof transformers actually are not required. This *exclusive* Westinghouse design was created to fill the need felt by many customers for a dependable, high-performance current transformer without the "extras" furnished in present molded indoor-outdoor units. As the specification sheet below shows, we've offered this economy without any compromise in ASA standards. And the net saving per unit is just about $12.

**Let's take a look at performance specifications**—Westinghouse Type RT Low-Voltage Transformer

1. 600-volt class, available in current ratings of 200/5 and 400/5 amperes.
2. Meets standard ASA 0.3 accuracy class.
3. Rating factor of 2.0.
4. Available with high or low base.
5. Stud-type connector.

Your Westinghouse sales engineer can show you how the RT can make substantial savings for you when mounted in an enclosure.

J-70916

**BONUS VALUES BEYOND THE SPECIFICATION**

**YOU CAN BE SURE... IF IT'S Westinghouse**

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# Readers Service

**For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:**

**NEW EQUIPMENT**

H. K. Porter.....Interrupter ☐
Worthington .....Compressor ☐
Allis-Chalmers .....Controllers ☐
Holan .....Pole Jack ☐
Fisher-Pierce .....Control ☐
I-T-E .....Circuit Breaker ☐
Charleston .....Glove ☐
Weed Control Service...Chipper ☐
Peters .....Tape ☐
GE .....Motors ☐

**OTHER**

Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

* Note: Requests must be received within four weeks of publication date, accompanied by complete information specified. This service cannot be offered to readers in foreign countries or to competitive manufacturers.

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FOR:
Reference ..... ☐
Specs ..... ☐
Trial ..... ☐
Purchase ..... ☐

**JUNE 1, 1959**

## Circuit Breaker . . .

(*Continued from page 77*)

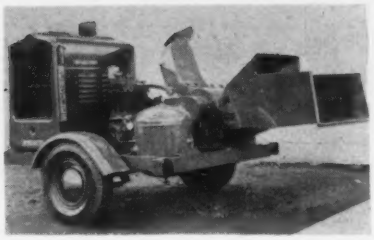
for NEMA 1A applications, is similar to the general purpose U-Re-Lite, but provides in addition a gasketed air-tight front cover. Front cover opening permits check of position indicator, while side opening allows check of contact position.
**I-T-E Circuit Breaker Co, 1900 Hamilton St, Philadelphia 30, Pa.**

## Rubber Glove . . .

**. . . has black exterior and bright red interior.** The "Red 'N Black" glove is available in curved hand and contour cuff styles as well as regular styles. If the glove has been damaged by snagging or cutting, the black exterior is penetrated and the red interior showing through indicates that the damage is substantial.
**Charleston Rubber Co, Stark Industrial Park, Charleston, S. C.**

## Wood Chipper . . .

**. . . is designed for disposal of brush** and forest slash in the clearance of rights-of-way. The improved chipper features a Hercules WXLC-3 six-cylinder L-head gasoline closed power unit that delivers 312 ft-lb of torque at 1,300 rpm and 132 hp at 2,400 rpm. The more powerful engine permits easier handling of the



sudden load produced when solid material is pushed against knives.
**Weed Control Service, Inc, 2605 S W First Ave, Portland 1, Ore.**

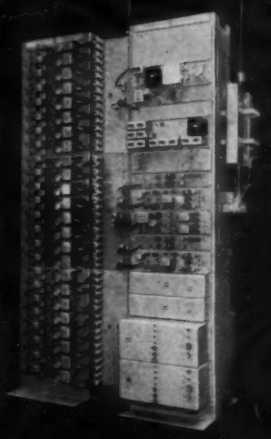
## Electrical Tape . . .

**. . . will heat seal in the 200F temperature range.** The Rubber Coated Mylar tape gauges 3 mils (using 1 mil base film), is coated on one side and may be furnished in any color. In addition to heat sealing, other advantages are thinness of gauge, waterproofing qualities and absence of plasticizer migration. The tape is UL approved for use over single conductors in service entrance cable.
**Peters Mfg Co, 162 Old Colony Ave, Wollaston 70, Mass.**

## Dripproof Motors . . .

**. . . have stator windings covered with silicone compound.** The Polyseal coating bonds to wire coils and steel stator laminations to provide a positive seal against moisture and contaminants. Silicone compound will not crack from heat expansion and contraction of coils and laminations. It is thin enough to provide proper heat transfer.
**General Electric Co, Schenectady 5, N. Y.**

# GENERAL ELECTRIC NOW OFFERS THE ONLY COMPLETE MICROWAVE LINE



2 kmc
6 kmc
time division
frequency division
now available

**By adding 6 KMC equipment to its 2 KMC line, General Electric now offers the first and only complete line of microwave in the industry.**

### Proved Reliability

General Electric microwave equipment has earned an outstanding reputation for dependability. Southern Colorado Power Company, for example, enjoyed a reliability factor of 99.99 percent in 18,360 hours of operation using General Electric 2 KMC equipment. This same reliability is engineered and built into the new 6 KMC product.

### More Flexibility for Systems Designers

Microwave systems designers now have a wider choice than ever before *from one unbiased source.* They not only can choose between 2 and 6 KMC equipment, but also between time and frequency division multiplexing. Thus systems planners can pick the exact product or combination of products to suit their needs, providing from one to 120 voice channels for communication or control.

For complete information on General Electric microwave, contact your G-E communications consultant, listed under "Radio Communication Equipment" in the Yellow Pages. Or write General Electric Company, Communication Products Dept., 9659-1, Mountain View Road, Lynchburg, Va.

*Progress Is Our Most Important Product*

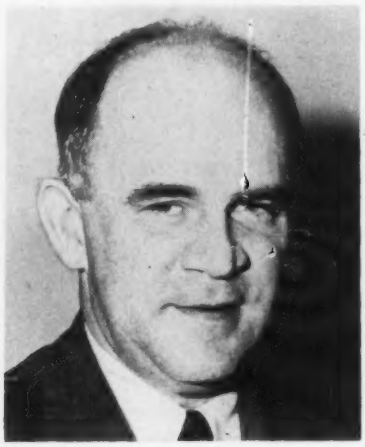
GENERAL ELECTRIC

Communication Products Dept.

# News About People

CLAWSON

KIMBALL



FONTAINE

## Puget Sound Names Three Vice Presidents

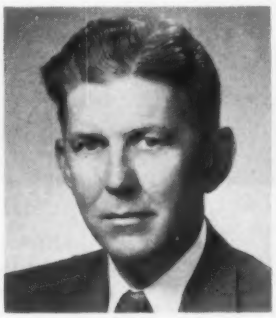
Puget Sound Power & Light Co has named three new vice presidents. J. H. Clawson was elected senior vice president; Frederick W. Kimball, vice president-administration; and Edward A. Fontaine, vice president-operations.

Clawson, who was formerly vice president and treasurer, joined the utility in 1933 as an auditor, after 11 years in that capacity with Stone & Webster. Three years later, he was appointed assistant treasurer and, in 1946, added the duties of controller. The following year, he was named treasurer and then vice president in 1958.

Kimball had been with Booz, Allen, & Hamilton, management consultants, since 1952. He was also a research engineer for Stanford Research Institute.

Fontaine joins Puget Sound from Stone & Webster Service Corp where he was manager of the electric department. He joined Stone & Webster in 1949.

SEDBERRY



DODSON

MONTGOMERY

SWARTZ

## Three Companies Elect New Vice Presidents

Four new vice presidents have been elected recently: W. J. Sedberry and Robert W. Dodson of Southwestern Electric Power Co; W. E. Montgomery of Southern California Edison Co; and Howard M. Swartz of West Penn Power Co.

Sedberry started with Southwestern in 1931 as cashier in Gladewater, Tex., and was named East Texas Division manager in 1955. Dodson, who has been superintendent of power since 1954, started with the utility in 1934. He was later named to the position of supervisor of plant.

Montgomery began with SoCal in 1926. His posts have included operating engineer, general superintendent of system operation, and manager of operation. In 1957, he was made general manager-operations.

Swartz spent six years in general law practice before he joined the Philadelphia Co and its subsidiaries in 1939. He was then with Duquesne Light Co for 18 years.

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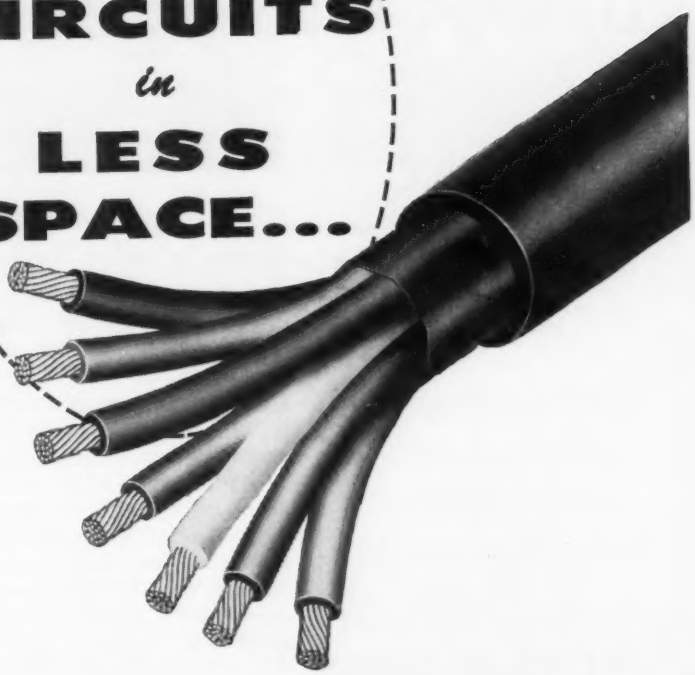

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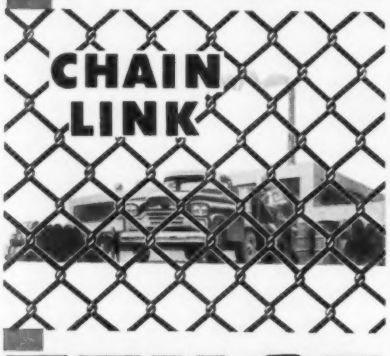


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—quality materials
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## Martin Appointed B&W Domestic Sales Manager

John G. Martin has been named domestic sales manager of Babcock & Wilcox Co's boiler division. Succeeding Martin as manager of the Cincinnati, O., district sales office is William E. Butler, former sales engineer in the Syracuse office.

Martin joined B&W as a student engineer in 1929. He transferred to the Cincinnati office in 1931, and he was promoted to assistant district manager in 1948, and district manager in 1954. Butler has been with B&W since 1936.

## American Steel & Wire Names New Sales Manager

Boyd P. Doty, Jr., has been appointed general sales manager for American Steel & Wire.

Doty moves from his post of Cleveland district sales manager for U. S. Steel. He began his career in 1934 with American Sheet and Tin Plate Co, which became a part of Carnegie-Illinois, a former subsidiary company of U. S. Steel. He was appointed assistant manager of sales in Detroit in 1957. The next year, he was made district manager of sales in Cleveland.

## *PERSONAL BRIEFS*

**A. B. Robertson,** vice president and general solicitor, British Columbia Electric Co, has been named vice president and general counsel. **D. M. M. Goldie** has been appointed general solicitor.

West Penn Power Co has appointed **Stanley E. Smith,** supervisor of controls engineering in the electrical engineering department.

**Mrs. Margaret C. Swift** has been appointed the first woman member of the Massachusetts Department of Public Utilities for a 5-yr term.

**Dr. Gordon S. Brown** has been appointed dean of the School of Engineering at Massachusetts Institute of Technology, succeeding **Dean C. Richard Soderberg,** who has been named a professor.

**Charles W. George** has been appointed manager-engineering for General Electric Co's Gas Turbine Dept. He was manager of SAR reactor engineering at the Knolls Atomic Power Laboratory in Schenectady, N. Y. Two new operations analysts have been added to the staff of GE's Computer Dept in Phoenix, Ariz: **Dr. G. E. Adams,** and **R. J. Noorda.**

Westinghouse Electric Corp has made two changes in the district sales office of its apparatus division. **Leonard H. Loufek** has been appointed district manager of the Chesapeake, Md., district office, and **H. E. Robertson** who previously held the post has been appointed marketing director of apparatus products in Pittsburgh. In another move, **Dr. Woodrow E. Johnson** has been appointed director of projects for the atomic power department at Westinghouse.

## Tools For Integrated System Planning

(*Continued from page 59*)

approach are more attractive today because of a slowing down of the rate of improvement in conventional steam station heat rates and the fact that low cost gas turbine generating units of moderately large capacity have recently become available on the market.

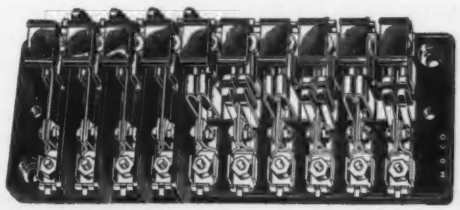
**Future generation patterns:** An extension of the concept of peaking generation indicates that on future power systems it may be economical to use three types of generation. Highest efficiency steam plants that can be base loaded throughout their life; lower efficiency steam stations for the intermediate portion of the load; and low cost gas turbines for the peaking portion. As nuclear power is developed, it will first become economical for high load factor operation and thus will replace the high efficiency steam plants.

Facing the industry today is the important problem of determining optimum power system reliability. Present practices are to use an index of reliability that has given satisfactory performance in the past. A more critical evaluation of reliability would involve study of the parameters shown in Figure 5. Based on the methods previously described, it is possible to establish cost as a function of reliability. The corresponding worth of such reliability is not well known but is predicted to have a shape such as that indicated in Figure 5. This worth should include not only direct tangible cost but also such intangibles as customer good will. The optimum reliability would occur when the incremental change in worth with respect to reliability is equal to the incremental change in cost with respect to reliability.

Today the use of probability methods to examine over-all system design is somewhat limited by the dearth of outage data for various system components. The work on the outage rates of generating units has been very valuable and should be extended to cover transmission components as well as individual components of the generation cycle. However, even with some of these parameters incompletity defined, important knowledge can be obtained by studies in which the parameters are varied through their probable range.

The concept of integrated system planning as presented here involves the evaluation of the present worth of all pertinent system costs for each alternative plan, with the condition that each alternative provide the same reliability in meeting the system load. If the various plans provide different reliabilities, this difference must be considered in choosing the optimum design.

Accurate evaluation of system plans according to these concepts has been made practical by the development of new mathematical and computing tools. Use of these tools will sharpen judgment in the critical evaluation of system plans and look to significant savings in system planning.

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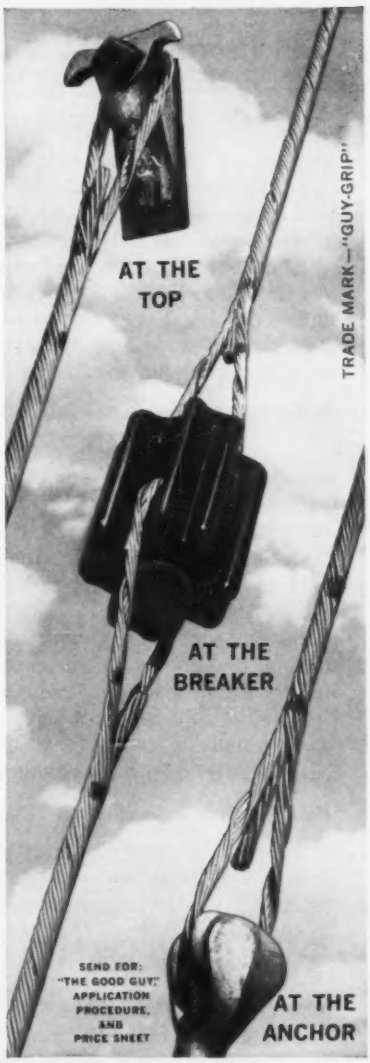


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DEPT. GG 2A
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# Guides Reduce Storage Battery Costs—I*

## Application engineering of lead-acid batteries by Gulf States Utilities Co leads to guides for proper selection and sizing and facilitates comparison of costs

**LEROY J. BODEMAN**, Equipment Application Engineer, Gulf States Utilities Co., Beaumont, Tex.

Procedure facilitates the application engineering and purchasing of storage batteries. It involves use of specially developed guides to assure proper selection and sizing of batteries and to compare their annual costs, considering differences in life expectancies.

Benefits realized since adopting this procedure three years ago: **1.** Economic savings by minimizing service interruptions. **2.** Outages reduced due to undersized batteries. **3.** Oversizing of batteries eliminated. **4.** Correct life expectancy for the application is assured.

### Rules for Applying Batteries Throughout System

**1.** For generating substations and large transmission substations, use 12 to 15-yr or 14 to 20-yr lead-acid batteries for breaker tripping, emergency lighting, emergency power, and indicating lamps.

**2.** For distribution substations, use 12 to 15-yr lead-acid batteries for breaker tripping, emergency lighting, and indicating lamps.

**3.** For supervisory requirements or certain breaker tripping requirements, where continuous current drain is very small, use nickel-cadmium batteries.

**4.** For applications where operating temperatures are normally in excess of 100F, use 8 to 10-yr lead-acid batteries or nickel-cadmium batteries.

### How To Size a Lead-Acid Battery

Load on control bus is divided into three classes:

**1. Momentary currents** for operation of circuit breakers. Maximum ampere demand is determined by the number of breakers closed or tripped simultaneously—not sequentially. Usually one breaker will be closed at a time, and not more than half of the station's breakers can be assumed to be tripped simultaneously. The number of breakers operated simultaneously must be determined accurately, because momentary current is a major requirement of battery capacity.

Although some circuit operating mechanisms are only energized for a fraction of a second, duration of the momentary current is assumed to be 1 min, which is the basis for the maximum ampere rating of batteries.

**2. Continuous current** of indicating lamps, holding coils for relays, and other control devices. These loads must be carried by the battery, without the help of a charger, for 12 hr. If the 12-hr discharge curve is not given for a battery, the discharge rate should be assumed to be 72% of the 8-hr discharge current.

**3. Current for emergency lighting and power.** This load is assumed to be supplied from the battery for 3 hr.

After the minimum requirements are determined for the load classes, the proper type of battery is selected as well as the type of cells. Then the number of positive plates is computed for each of the three loads. The sum of these plates will be the total number of positive plates required per cell.

### Example Illustrates Procedure

GIVEN—Classes of loads are:

**1.** A remotely operated station has five breakers that require 15 amp each for closing or tripping operations. Because all breakers could be tripped simultaneously, the total maximum current is 75 amp.

**2.** Continuous load comprises 0.55 amp for five indicating lamps on the breakers and 2.5 amp for a carrier set. This load is to be supplied for 12 hr.

**3.** Emergency lighting and power requires 15 amp for 3 hr.

SOLUTION—Assuming a 12 to 15-yr battery, a cell type is selected having a 1-min rate in excess of the 75-amp momentary requirement. Then the number of positive plates required in the complete cell is computed for each load class as follows:

**1.** Momentary current of 75 amp divided by the positive plate 1-min rate of 34.9 amp equals 2.15 positive plates. (Positive plate rates for different durations are given in manufacturers' catalogs.)

**2.** Continuous load of 3.05 amp divided by positive plate 12-hr rate of 1.80 amp equals 1.695 positive plates.

**3.** Emergency lighting and power load of 15 amp divided by positive plate 3-hr rate of 5.2 amp equals 2.88 positive plates.

RESULT—The total (2.15 + 1.695 + 2.88) or 6.725 indicates that seven positive plates must be used. Because the number of plates in a cell is twice the number of positive plates plus one, the battery would require 15 plates. If the number of positive plates exceeds that of the largest cell being considered, calculations must be repeated using the next larger cell.

**Notes**—To avoid having too great an excess capacity, the number of positive plates is adjusted using the following rule: If the number of positive plates calculated includes a fractional plate which is not more than 5% of the whole number, the fraction may be neglected; but if the fractional plate exceeds the whole number by more than 5%, one positive plate should be added.

These calculations apply to a battery operating at normal room temperature. For operation at lower temperatures, additional capacity must be provided.

* Part II—"Application Engineering of a Nickel-Cadmium Battery", and Part III—"A Method to Determine the Annual Cost of a Battery" will appear in subsequent issues.

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# Readers Forum

### Price of Gasoline in Britain

To the Editor:

On page 46 of your issue of April 27, you have mentioned a price of 70¢ a gallon for gasoline. Even though we pay 35¢ tax on each Imperial gallon, things are not quite that bad!

The gas station around the corner sells three grades of gasoline at 4/3d, 4/8½d, and 4/11½d a gallon. Using the middle price in the example, my slide-rule pushing goes as follows:

1 Imperial gallon = 4/8½d = 56½ pence

But, at yesterday's market

prices £1 = $2\frac{82}{100}$

Hence 240 pence = 282¢

and 1 penny = 1.175¢

Thus 1 Imperial gallon = 66.4¢

But 1 Imperial gallon = 1.205 U.S. gallons

Hence 1 U.S. gallon = 55.2¢

The price of 70¢ a gallon is high even if it refers to an Imperial gallon —this is the price of the top grade of gasoline. Your readers will surely make their comparisons on a U.S. gallon basis, and in this case the price you quoted is 27% high.

A. R. Parish

W. S. Atkins and Partners
158 Victoria Street
London, S. W. I.
England

### Burbank Sticks with Gas

To the Editor:

We have observed that an incorrect statement was made on page 83 of the April 6 issue of "Electrical World" in the Management Newsletter under the Pacific area concerning fuel plans for the City of Burbank. The statement made is as follows: "The City of Burbank, however, has revised 1965 plans even more drastically in the opposite direction—from 85% gas to 80% oil."

There is no major change expected in our fuel position as our fuel consumption is subject to the same conditions and regulations as that of other utilities in this area. Therefore, the figures should read from 85% gas to 80% gas. The information may have been erroneously reported to you from the Keystone Coal Buyers Manual.

We will appreciate your printing a correction to the above statement in your earliest issue, since it has been quite disturbing to us because of the many phone calls we have had concerning this statement.

Ralph Foy
General Manager

Public Service Department
City of Burbank
164 West Magnolia Blvd.
Burbank, Calif.

*We regret the error. The information was taken, as you surmise, from published sources. However, we intend to tighten our checks on such matters in the future to prevent recurrences. We are sorry for the inconvenience caused you.*

### Where 240/416-v Is Best

To the Editor:

Page 86 of the May 18 issue has a typographical error in the third reason "Why 240/416-v Service is Best." It should read:

**"3.** Adoption of the 416-v system and 416-v motors would not lead inherently to voltage troubles and a long period of 'creeping' to higher values."

Thus corrected, it takes its proper place with the other two reasons:

**"1.** Existing investment in 265/460 and 480-v delta systems should not deter a utility from accepting the 240/416-v system.

**"2.** The 416-v system in the long run should not result in split production, duplicate inventories, and confusion in application."

I would appreciate your calling this to the attention of your readers at an early date.

My proposal of 240/416 v is for general 3-phase service, not for residences (as inferred on p. 20) where single phase would suffice. Thus there is no conflict between it and the 240/480-v single-phase system espoused for new homes in the same issue.

A. S. Anderson
Electrical Engineer

EBASCO Services Inc.
2 Rector St.
New York 6, N. Y.

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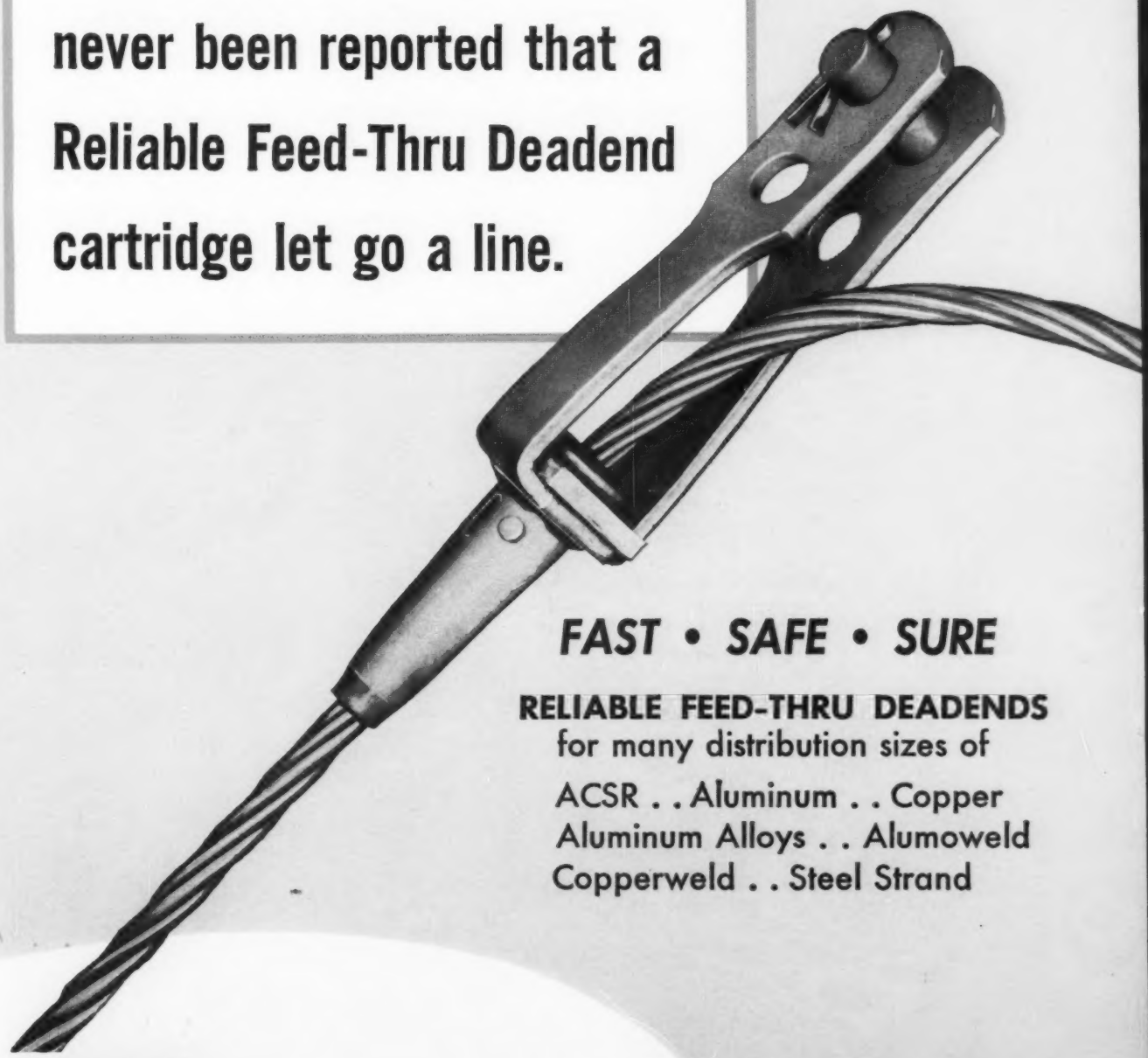

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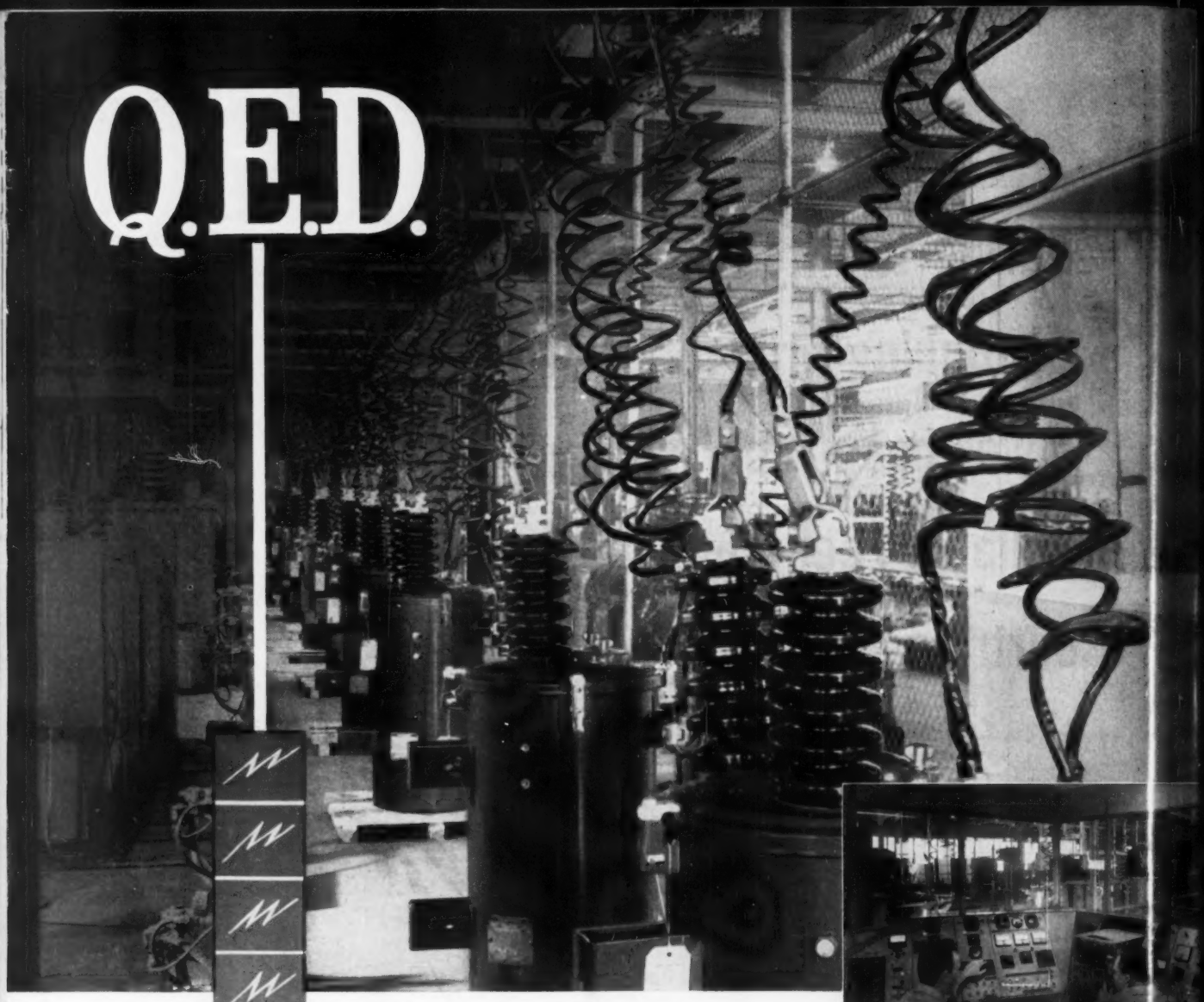

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